<u>OmDayal Group of Institutions</u>

Department of Basic Science and Humanities

Subject Code: **BS-PH101**	Category: **Basic Science Courses**
Subject Name: **Physics-I**	Semester: **First**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

To motivate or challenge students to understand basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Mechanics:** Problems including constraints & friction. Basic ideas of vector calculus and partial Differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.	7
2	**Optics:** Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications. Polarisation: Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity. Lasers: Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples.	5
3	**Electromagnetism and Dielectric Magnetic Properties of Materials:** Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation(expression only), applications of dielectrics. Magnetisation , permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.	8
4	**Quantum Mechanics:** Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.	16
5	**Statistical Mechanics:**	8

	Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.	

Course Outcomes:

1. Upon completion of this course, students will be able to understand the Basic concepts of mechanics, effect of various types of forces on a body, causes and effects of vibration.
2. Students will be able to interpret the intensity variation of light due to Polarization, interference and diffraction, transverse nature of Light-Polarization, Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
3. Upon completion of this course, students will be able to understand the magnetic and dielectric properties of various material and also properties of materials such as, permeability, polarization, etc .
4. Students will be familiar with some of the basic laws related to quantum mechanics as well as simple quantum mechanics calculations.
5. Upon completion of this course, students will be able to understand the application of statistical Mechanics in case of Engineering Thermodynamics.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSPH101.CO1	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO2	3	3	3	3	3	2	_	_	_	_	_	3
BSPH101.CO3	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO4	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO5	3	3	3	3	2	2	_	_	_	_	_	3
Average	3	3	3	3	2.8	2.6	_	_	_	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Department ofComputer Science and Engineering

Subject Code: BS-M101	Category: Basic Science Course
Subject Name: Mathematics – I A	Semester: **I**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:
To motivate students to understand the basic concepts calculus differentiation and integration, evolutes, vector space and with its property, eigen values and eigen vectors and study the different types matrices.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Calculus (Integration):** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions	8
2	**Calculus (Diferentiation):** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	**Matrices:** Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	**Vector Spaces:** Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	**Vector Spaces** (Continued): Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:
1. Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
2. Understand the domain of applications of mean value theorems to engineering problems.
3. Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.
4. Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.
5. Learn and apply the concept of eigen values, eigen vectors, diagonalization of matrices and orthogonalization in inner product spaces for understanding physical and engineering problem.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSM101.CO1	2	3	3	3	_	1	_	_	_	_	_	3
BSM101.CO2	2	3	3	3	_	1	_	_	_	_	_	3
BSM101.CO3	2	2	3	3	_	1	_	_	_	_	_	3
BSM101.CO4	2	3	3	3	_	_	_	_	_	_	_	3
BSM101.CO5	2	3	2	3	_	1	_	_	_	_	_	3
Average	2	2.8	2.8	3	_	1	_	_	_	_	_	3

Course Code : ES-EE101	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering	**Semester** : First
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections. **Module 4: Electrical Machines (8 hours)**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction

and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Course Outcomes

1. To understand and analyze DC circuits and relevant theorems.

2. To understand different AC network theorems, circuits and tools for solution of networks.

3. To study the working principles of power converters.

4. To introduce the components of low voltage electrical installations.

5. To understand basic concepts, construction, working principle and fundamentals of Electric Machines.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-EE101.CO1	3	3	3	2	3	3	1	-	-	-	-	3	-	-	-	-
ES-EE101.CO2	3	3	3	2	3	3	1	-	-	-	-	3	-	-	-	-
ES-EE101.CO3	3	3	3	2	3	3	2	-	-	-	-	3	-	-	-	-
ES-EE101.CO4	3	3	3	1	3	3	2	-	-	-	-	3	-	-	-	-
ES-EE101.CO5	3	3	3	1	3	3	2	-	-	-	-	3	-	-	-	-
Average	3	3	3	1.6	3	3	1.6	-	-	-	-	3	-	-	-	-

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: To learn the concepts and methodologies of computer systems.

PSO2: To gain the knowledge of software development life cycles.

PSO3: To learn the concepts of recent developments in computer technologies.

PSO4: To apply the above knowledge in real life applications.

OmDayal Group of Institutions

Department of Department of Basic Science and Humanities

Course Code : BS-PH191/ BS-PH291	**Category :** Basic Science course
Course Title : Physics-I Laboratory	**Semester** : First/ Second
L-T-P : **0-0-3**	**Credit:1.5**

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and QuantumMechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton’s ring
3. Determination of wavelength of a monochromatic light by Fresnel’s bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson’s method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of aphotovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variationof logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster’s bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes

9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectralresponse of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and sheer force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity andto determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

Course Outcomes:

1. Analyses the physical properties of Light as well as the phenomenon of Dispersion to perceive concepts of modern optics.

2. Determine electrical and magnetic properties.

3. Measure some quantum mechanical constants.

4. Analyses the different parameter related to general properties of matter.

5. Determine the elastics and viscous properties.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSPH191.CO1	3	3	3	3	2	1	_	_	3	_	_	3
BSPH191.CO2	3	3	3	3	3	1	_	_	3	_	_	3

BSPH191.CO3	3	2	3	3	3	1	_	_	3	_	_	3
BSPH191.CO4	3	3	3	3	2	_	_	_	3	_	_	3
BSPH191.CO5	3	3	3	3	2	1	_	_	3	_	_	3
Average	3	2.8	3	3	2.4	1	_	_	3	_	_	3

PO1: Engineering Knowledge

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PO8: Ethics

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PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learnin

Course Code : ES-EE191	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	**Semester** : First
L-T-P : **0-0-2**	**Credit: 1**
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do’s and Don’ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about

the modalities of evaluation.

2. Introduction and uses of following instruments :
   (a) Voltmeter
   (b) Ammeter
   (c) Multimeter
   (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronousmachine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change involtage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation ofimpedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer

(b) Load test of the transformer and determination of efficiency and regulation

9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shiftsbetween the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change ofphase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter forspeed control of an Induction motor
15. Demonstration of components of LT switchgear.

Course Outcomes

1. To understand basic safety precautions and instructions.
2. To understand the concept of calibration of ammeter and wattmeter, basics of active power and reactive power, balanced, unbalanced system and power measurement.
3. To understand steady state and transient response of R-L, R-C and R-L-C circuit, resonance frequency and quality factor.
4. To study open circuit and short circuit test of a single-phase transformer
5. To study the torque-speed characteristics of separately excited dc motor, induction motor and operating characteristics of synchronous generator.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-EE191.CO1	3	3	3	2	3	3	3	2	3	3	-	3	-	-	-	-
ES-EE191.CO2	3	3	2	2	3	3	2	-	-	-	-	3	-	-	-	-
ES-EE191.CO3	3	3	3	2	3	3	2	-	-	-	-	3	-	-	-	-
ES-EE191.CO4	3	3	3	1	3	3	-	-	-	-	-	3	-	-	-	-
ES-EE191.CO5	3	3	3	1	3	3	-	-	-	-	-	3	-	-	-	-
Average	3	3	3	1.6	3	3	2.3	2	3	3	-	3	-	-	-	-

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PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: To learn the concepts and methodologies of computer systems.

PSO2: To gain the knowledge of software development life cycles.

PSO3: To learn the concepts of recent developments in computer technologies.

PSO4: To apply the above knowledge in real life applications.

OmDayal Group of Institutions

Department of Civil Engineering

Course Code: ES-ME192	**Category:** Engineering Science Courses
Course Title: Workshop/ Manufacturing Practices	**Semester**: First
L-T-P: **1-0-4**	**Credit:3**

Course Syllabus

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)
Typical jobs that may be made in this practice module:
One/ two green sand moulds to prepare, and a casting be demonstrated.

Smithy (4 hours) ~ 4 hours
Typical jobs that may be made in this practice module:
A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)
Typical jobs that may be made in this practice module:
For plastic moulding, making at least one simple plastic component should be made.
For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)
Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable. Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.
Simple wiring exercise to be executed to understand the basic electrical circuit. Simple soldering exercises to be executed to understand the basic process of soldering. Fabrication of a single-phase full wave rectifier with a step-down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their
own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: To learn the concepts and methodologies of computer systems.

PSO2: To gain the knowledge of software development life cycles.

PSO3: To learn the concepts of recent developments in computer technologies.

PSO4: To apply the above knowledge in real life applications.

CO-PO Mapping:

Program outcomes/ PSO → / Course ↓ outcome	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	1	-	-	-	-	-	3	1	-	3	-	-	-	-
CO2	1	-	1	-	1	-	-	-	3	-	-	3	-	-	-	-
CO3	1	-	1	-	1	-	-	-	3	1	-	3	-	-	-	-
Avg	1	-	1	-	1	-	-	-	3	1	-	3	-	-	-	-

Note:

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Chemistry

Course Code : BS-CH201	**Category :** Basic Science Courses
Course Title : Chemistry-I	**Semester** : Second
L-T-P : **3-1-0**	**Credit:4**

Course Objectives:
To motivate students to understand the basic concepts of atomic and molecular structure, spectroscopic techniques and applications, free energy and equilibrium, periodic properties of elements and stereochemistry and structures of compounds and study the different types of organic reactions

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Atomic and molecular structure:** Schrodinger equation. Particle in box solutions and their applications for simple sample. Molecular orbitalsof diatomic molecules (e.g.H_2). Energy level diagrams of diatomic. Pi-molecular orbital of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.	10
2	**Spectroscopic techniques and applications** Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering	8
3	**Intermolecular forces and potential energy surfaces** Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena	4
4	**Use of free energy in chemical equilibria** First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.	8
5	**Periodic properties** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries	4
6	**Stereochemistry** Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds	4

7	**Organic reactions and synthesis of a drug molecule** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization andring openings. Synthesis of a commonly used drug molecule.	4

Course Outcomes:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electro negativity, oxidation states andelectro negativity.
5. List major chemical reactions that are used in the synthesis of molecules.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BS-CH201.CO1	2	2					2					2
BS-CH201.CO2	2	2	2				2					2
BS-CH201.CO3	2	2	2		2		2					2
BS-CH201.CO4	2	2					2					2
BS-CH201.CO5	2	2	2		2							2
Average	2	2	2		2		2					2

PO1: Engineering Knowledge

PO2: Problem Analysis

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PO12: Life-long Learning

OmDayal Group of Institutions

Department ofComputer Science and Engineering

Subject Code: BS-M201	Category: Basic Science Course
Subject Name: Mathematics – II A	Semester: **II**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:
To motivate or challenge students to understand the concept of probability theory and their different types probability distribution functions and study the different types of hypothesis.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	**Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities..	4
3	**Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	**Basic Statistics:** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	**Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:
1. Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.
2. Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.
3. Apply statistical tools for analysing data samples and drawing inference on a given data set.
4. Learn the basic ideas of curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves and their applications in physical and engineering environment.

5.Understand the ideas of different types of Testing of significance and their different type of problems.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSM201.CO1	2	3	3	2	_	_	_	_	_	_	_	3
BSM201.CO2	_	2	3	1	_	_	_	_	_	_	_	3
BSM201.CO3	_	3	3	3	_	_	_	_	_	_	_	3
BSM201.CO4	_	3	3	3	_	_	_	_	_	_	_	3
BSM201.CO5	_	3	3	3	_	_	_	_	_	_	_	3
Average	2	2.8	3	2.4	_	_	_	_	_	_	_	3

OmDayal Group of Institutions

Department of Computer Science and Engineering

Subject Code: ES-CS201	*Category:* Engineering Science Courses
Subject Name: Programming for Problem Solving	*Semester:* ***II***
L-T-P: : 3-0-0	*Credit:**3***

PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: To learn the concepts and methodologies of computer systems.
PSO2: To gain the knowledge of software development life cycles.
PSO3: To learn the concepts of recent developments in computer technologies.
PSO4: To apply the above knowledge in real life applications.

Course Name: Programming for problem solving (ES-CS201):

Course Outcomes:

ES-CS201.1: To formulate simple algorithms for arithmetic and logical problems.To translate the Algorithms to programs (in C language).
ES-CS201.2: To test and execute the programs and correct syntax and logical errors.To implement Conditional branching, iteration, and recursion
ES-CS201.3: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
ES-CS201.4: To use arrays, pointers, and structures to formulate algorithms and programs.
ES-CS201.5: To apply programming to solve matrix addition and multiplication problems and searching,sorting problems. To apply programming to solve simple numerical method problems, namely rot finding offunction, differentiation of function and simple integration.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-CS201.1	2	3	1	1	1	1	2	3	-	2	3	1	2	2	1	-
ES-CS201.2	3	1	2	1	2	1	-	-	3	2	2	2	3	2	3	1

ES-CS201.3	2	3	2	2	2	-	2	3	3	2	3	2	2	-	3	3
ES-CS201.4	2	3	3	2	-	2	1	2	2	3	1	-	2	3	2	2
ES-CS201.3	3	3	2	2	2	2	1	-	3	3	2	3	3	3	2	1
Average	2.4	2.6	2	1.6	1.4	1.2	1.2	1.6	2.2	2.4	2.2	1.6	2.4	2.0	2.2	1.4

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put"-"

Subject Code: ES-CS291	*Category:* Engineering Science Courses
Subject Name: Programming for Problem Solving Lab	*Semester:* ***II***
L-T-P: : 3-0-0	*Credit:**3***

Course Objectives:
Learn preprogramming steps like writing algorithms, drawing flowcharts. Understand the structure,and learn the syntax and semantics of C programming .variable declaration with different data types and using operators. Concept of different control structures like decision control, loop control and special the concepts and advantages of using functions.¬ Understand the limitations of basic data types and concepts of derived. data types and user defined data types. Learn how to perform various FILE I/O.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	**Introduction to Programming** : Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) . Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory	*4*
2	Arithmetic expressions and precedence.	*2*
3	**Conditional Branching and Loops**: Writing and evaluation of conditionals and consequent branching . Iteration and loops	*6*
4	Arrays : Arrays (1-D, 2-D), Character arrays and Strings	*6*
5	Basic Algorithms : Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)	*6*
6	Function : Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference	*5*
7	Recursion : Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	*5*

8	Structure :Structures, Defining structures and Array of Structures	*4*
9	Pointers : Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list(no implementation)	*2*
10	File handling	*2*

PROGRAM SPECIFIC OUTCOMES (PSO)
PSO1: To learn the concepts and methodologies of computer systems.
PSO2: To gain the knowledge of software development life cycles.
PSO3: To learn the concepts of recent developments in computer technologies.
PSO4: To apply the above knowledge in real life applications.
Course Name: Programming for problem solving (ES-CS201):

Course Outcomes:

Course Name: Programming for problem solving (ES-CS291):

ES-CS291.1: To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).

ES ES-CS291.2: To test and execute the programs and correct syntax and logical errors. To implement conditional branching, iteration and recursion.

ES-CS291.3:To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

ES-CS291.4: To use arrays, pointers and structures to formulate algorithms and programs. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

ES-CS291.5: To apply programming to solve simple numerical method problems, namely rot finding of function, Differentiation of function and simple integration

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-CS291.1	2	3	1	1	1	1	2	3	-	2	3	1	2	2	1	-
ES-CS291.2	3	1	2	1	2	1	-	-	3	2	2	2	3	2	3	2
ES-CS291.3	1	3	1	2	2	-	2	3	3	2	3	2	2	-	3	3
ES-CS291.4	2	3	3	2	-	2	1	2	2	3	1	-	2	3	2	2
ES-CS291.3	3	3	2	2	2	2	1	-	3	3	2	3	3	3	2	1
Average	2.2	2.6	1.8	1.6	1.4	1.2	1.2	1.6	2.2	2.4	2.2	1.6	2.4	2.0	2.2	1.6

OmDayal Group of Institutions
Department of English

Course Code : HM HU 201	**Category :** Humanities and social sciences Courses
Course Title : English	**Semester** : Second
L-T-P : 2-0-0	**Credit:2**

COURSE OBJECTIVE:

To help students develop basic proficiency in English Grammar, Vocabulary and Composition, and writing skills.
To help students identify common errors in writing and gain editing skills in the process.
To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs and emails.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	1. Vocabulary Building 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending. 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms	8
2	2. Basic Writing Skills 2.1 Sentence Structures & Types: Simple, Compound, Complex 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration 2.3 Importance of proper punctuation 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order 2.5 Creating Cohesion: Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely	10
3	**3.** Identifying Common Errors in Writing 3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés	8
4	4. Nature and Style of sensible Writing 4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion	10
5	5. Writing Practices 5.1 Comprehension 5.2 Précis Writing 5.3 Essay Writing 5.4 Business Letter, Cover Letter & CV; E-mail	8

Course Outcome:

The student will acquire basic proficiency in English including reading and listening comprehension.

The student will acquire basic proficiency in English grammar and vocabulary.

The student will acquire basic proficiency in writing basic technical documents such as business letters, cover letters, CV and emails.

The student will acquire basic proficiency in understanding the nature and style of proper writing.

The student will learn to identify and edit common writing errors.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HMHU201.CO1	-	2	-	2	-	1	-	2	1	3	1	3
HMHU201.CO2	-	-	1	1	-	1	-	2	-	3	-	3
HMHU201.CO3	-	2	2	2	-	2	1	3	3	3	2	3
HMHU201.CO.4	-	2	1	-	-	-	1	3	2	3	-	3
HMHU201.CO.5	-	1	1	1	-	1	1	3	1	3	1	3
Average:	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

PO1: Engineering Knowledge
PO2: Problem Analysis
PO3: Design/Development of Solutions
PO4: Conduct Investigations of Complex Problems
PO5: Modern Tool Usage
PO6: The Engineer and Society
PO7: Environment and Sustainability
PO8: Ethics
PO9: Individual and Team Work
PO10: Communication
PO11: Project Management and Finance
PO12: Life-long Learning

OmDayal Group of Institutions

Department of Computer Science and Engineering

Subject Code: ES-ME 291	Category: Engineering Science Courses
Subject Name: Engineering Graphics & Design	Semester: 2nd
L-T-P: 1-0-4	Credit: 3

Course Objectives:

Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

CRITERION 3: Course Outcomes and Program Outcomes

3.1 Establish the correlation between the courses and the Program Outcomes (POs)
Program Outcomes:
PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSO)
PSO1: To learn the concepts and methodologies of computer systems.
PSO2: To gain the knowledge of software development life cycles.
PSO3: To learn the concepts of recent developments in computer technologies.
PSO4: To apply the above knowledge in real life applications.

Course Content:

Module No.	Content	Lecture (L)	Practical (P)
1	**INTRODUCTION TO ENGINEERING DRAWING** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	**LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales.	1	4
3	**GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral.	1	4
4	**PROJECTION OF POINTS, LINES, SURFACES** Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes	1	4

	(Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.		
5	**PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	**COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	**ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4
8	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULARSOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development ofsurfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	**OVERVIEW OF COMPUTER GRAPHICS**, C**USTOMISATION& CAD DRAWING** listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CADsoftware [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4

10	**ANNOTATIONS, LAYERING & OTHER FUNCTIONS** applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8
11	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).	2	8

Course Outcomes:

Course Name: Engineering Graphics & Design (ES-ME 291)

ES-ME 291.1: Introduction to engineering design and its place in society

ES-ME 291.2: Exposure to the visual aspects of engineering design

ES-ME 291.3: Exposure to engineering graphics standards

ES-ME 291.4: Exposure to solid modeling

ES-ME 291.5: Introduction to AutoCAD

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-ME 291.1	1	-	-	-	-	1	-	-	-	1	-	2	-	-	3	3
ES-ME 291.2	3	2	2	1	-	-	-	-	2	1	-	-	-	-	3	3
ES-ME 291.3	3	2	2	-	-	-	-	-	-	1	-	2	-	-	3	3

ES-ME 291.4	3	2	2	-	-	-	-	-	2	1	-	2	-	-	3	3
ES-ME 291.5	3	2	2	-	3	-	-	-	2	1	-	2	-	-	3	3
Average	2.6	2	2	1	3	1	-	-	2	1	-	2	-	-	3	3

OmDayal Group of Institutions

Department of Computer Science and Engineering

Name of the Course:	**Analog & Digital Electronics**	
Course Code: ESC-301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam : 70 Marks
Credit Points:	3	

Objective:	
1	To acquire the basic knowledge of different analog components and their applications
2	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
3	To prepare students to perform the analysis and design of various digital electronic circuits
Pre-Requisite:	
1	Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs,.
2	Basic concept of the working of P-N diodes, Schottky diodes,
3	Basic FETs and OPAMP as a basic circuit component. Concept of Feedback

Unit	Content	Hrs/Unit
1	Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer.	9
2	Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1’s and 2’s complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic expressions by algebraic method.	11

	Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator	
3	Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter	10
4.	A/D and D/A conversion techniques – Basic concepts (D/A :R-2-R only [2L] A/D: successive approximation [2L]) Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L)	6

Course Outcome: After completion of this course, the learners will be able to

1. Realize the basic operations of different analog components.
2. Realize basic gate operations and laws Boolean algebra.
3. Understand basic structure of digital computer, stored program concept anddifferent arithmetic and control unit operations.
4. Solve numerical problems of Boolean algebra, number system, combinational & sequential digital circuits and A/D and D/A converter.
5. Specify applications of combinational and sequential digital circuits.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ESC-391.1	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	2
ESC-391.2	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1
ESC-391.3	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1
ESC-391.4	3	3	3	3	1	-	-	-	3	3	-	1	3	-	1	2
ESC-391.5	3	3	2	2	1	-	-	-	3	3	-	1	3	-	3	3
Average	3	3	1.6	1.6	1	-	-	-	3	3	-	1	3	-	1.4	1.8

PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: To learn the concepts and methodologies of computer systems.

PSO2: To gain the knowledge of software development life cycles.

PSO3: To learn the concepts of recent developments in computer technologies.

PSO4: To apply the above knowledge in real life applications.

Subject Code: PCC-CS301	*Category:* Engineering Science Courses
Subject Name: Data Structure & Algorithm	*Semester:* ***III***
L-T-P: : 3-0-0	*Credit:**3***

Objective:

1 To learn the basics of abstract data types.

2 To learn the principles of linear and nonlinear data structures.

3 To build an application using sorting and searching

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique and their complexity analysis.	*10*
2	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	*9*
3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis	*10*
4	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	*9*

Course Name: Data Structure & Algorithm (PCC-CS301)):

PCC-CS301.1: Differentiate how the choices of data structure & algorithm methods impact the Performance of program
PCC-CS301.2: Solve problems based upon different data structure & also write programs.
PCC-CS301.3: Identify appropriate data structure & algorithmic methods in solving problem.
PCC-CS301.4: Discuss the computational efficiency of the principal algorithms for sorting,
PCC-CS301.5: Searching and Hashing

Course Name: Data Structure & Algorithm (PCC-CS301) :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-CS301.1	3	3	1	3	1	1	2	1	2	2	3	3	3	2	2	3
PCC-CS301.2	3	3	3	1	2	1	-	-	3	2	2	2	-	3	3	2
PCC-CS301.3	3	3	3	2	2	3	2	3	3	2	3	2	2	-	2	2
PCC-CS301.4	2	3	3	2	2	2	1	2	2	3	1	1	3	1	2	2
PCC-CS301.5	3	3	2	2	1	2	3	-	3	3	2	2	3	2	3	2
Average	2.8	3	2.4	2	1.6	1.8	1.6	1.2	2	2.4	2.2	2	2.2	1.6	2.4	2.2

Subject Code: PCC CS 302	Category: **Professional Core Course**
Subject Name:**Computer Organization**	Semester: III
L-T-P: **3-0-0**	Credit:**3**

Computer Organization

PCC CS-302

Pre-Requisite:

1.Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures.

2. Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming.

3. Boolean Algebra.

Course Objective :

1. To prepare students to perform the analysis and design of various digital electronic circuits.
2. To know how Computer Systems work & its basic principles
3. To know how I/O devices are being accessed and its principles etc

Course Outcome:

At the completion of the course, students will be able to…

CO1: Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.
CO2: Understand basic structure of different combinational circuits multiplexer,decoder, encoder etc.
CO3: Perform different operations with sequential circuits.
CO4: Understand memory and I/O operations& design of ALU.

Module No	**Description of Topic**	**Contact Hrs.**
1	Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. Commonly used number systems. Fixed and floating point representation of numbers.	8
2	Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. Design of ALU. Fixed point multiplication -Booth's algorithm. [1L] Fixed point division - Restoring and non-restoring algorithms. Floating point - IEEE 754 standard.	8
3	Memory unit design with special emphasis on implementation of CPU-memory interfacing.Memory organization, static and dynamic memory, memory hierarchy, associative memory. Cache memory, Virtual memory. Data path design for read/write access.	10
4	Design of control unit - hardwired and microprogrammed control. Introduction to instruction pipelining. Introduction to RISC architectures. RISC vs CISC architectures. I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA.	10

Program Outcomes POs of C.S.E. Department:

PO1 :	**ENGINEERING KNOWLEDGE**: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.
PO2 :	**PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 :	**DESIGN / DEVELOPMENT OF SOLUTIONS:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the Public health and safety, and the cultural, societal, and environmental considerations.
PO4 :	**CONDUCT INVESTIGATIONS OF Complex Problems:** Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 :	**MODERN TOOL USAGE:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering

	Activities with an understanding of the limitations.
PO6 :	**THE ENGINEER AND SOCIETY:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice.
PO7 :	**ENVIRONMENT AND SUSTAINABILITY**: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 :	**ETHICS:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 :	**INDIVIDUAL AND TEAMWORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.
PO10 :	**COMMUNICATION:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 :	**PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
PO12 :	**LIFE-LONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in Independent and life-Long learning in the broadest context of technological change.

Subject Code: PCC CS 302(Computer Organization)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC CS 302.1	3	3	2	2		1	2						1	2	2	1
PCC CS 302.2	3	3											2	1	2	2
PCC CS 302.3	2	1	3	3	3				1				1	1	1	1
PCC CS 302.4	3	2	3	2	2	2	2		1		2	2	1	1	1	2
Average	2.8	2.3	2	1.8	1.3	.8	1	0	.5	0	.5	.5	1.3	1.3	1.	1.5

1: Slightly 2: Moderately 3: Substantially

Name of the Course:	**Analog & Digital Electronics Lab**
Course Code: ESC-391	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

Laboratory Experiments:	
Analog Electronics	
1	Design a Class A amplifier
2	Design a Phase-Shift Oscillator
3	Design of a Schmitt Trigger using 555 timer
Digital Electronics	
4	Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
5	Construction of simple Decoder & Multiplexer circuits using logic gates.
6	Realization of RS / JK / D flip flops using logic gates
7	Design of Shift Register using J-K / D Flip Flop
8	Realization of Synchronous Up/Down counter
9	Design of MOD- N Counter
10	Study of DAC

Course Outcome: After completion of this course, the learners will be able to

6. Realize the basic operations of different analog components.
7. Realize basic gate operations and laws Boolean algebra.
8. Understand basic structure of digital system and different arithmetic and control unit operations.
9. Solve numerical problems of Boolean algebra, number system, combinational & sequential digital circuits and A/D and D/A converter.
10. Specify applications of combinational and sequential digital circuits.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ESC-391.1	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	2
ESC-391.2	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1

ESC-391.3	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1
ESC-391.4	3	3	3	3	1	-	-	-	3	3	-	1	3	-	1	2
ESC-391.5	3	3	2	2	1	-	-	-	3	3	-	1	3	-	3	3
Average	3	3	1.6	1.6	1	-	-	-	3	3	-	1	3	-	1.4	1.8

PROGRAM OUTCOMES (POs)

13. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
14. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
15. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
16. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
17. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
18. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
19. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
20. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
21. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
22. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
23. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
24. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: To learn the concepts and methodologies of computer systems.

PSO2: To gain the knowledge of software development life cycles.

PSO3: To learn the concepts of recent developments in computer technologies.

PSO4: To apply the above knowledge in real life applications.

Subject Code: PCC-CS391	*Category:* Engineering Science Courses
Subject Name: Data Structure & Algorithm	*Semester:* ***III***
L-T-P: : 3-0-0	*Credit:**3***

Objective:

1 To learn the basics of abstract data types.

2 To learn the principles of linear and nonlinear data structures.

3 To build an application using sorting and searching

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique and their complexity analysis.	*10*
2	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	*9*
3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis	*10*

4	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	*9*

Course Name: Data Structure & Algorithm (PCC-CS391)):

PCC-CS391.1: Differentiate how the choices of data structure & algorithm methods impact the Performance of program
PCC-CS391.2: Solve problems based upon different data structure & also write programs.
PCC-CS391.3: Identify appropriate data structure & algorithmic methods in solving problem.
PCC-CS391.4: Discuss the computational efficiency of the principal algorithms for sorting,
PCC-CS391.5: Searching and Hashing

Course Name: Data Structure & Algorithm (PCC-CS391) :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-CS391.1	3	3	1	3	1	1	2	1	2	2	3	3	3	2	2	3
PCC-CS391.2	3	3	3	1	2	1	-	-	3	2	2	2	-	3	3	2
PCC-CS391.3	3	3	3	2	2	3	2	3	3	2	3	2	2	-	2	2
PCC-CS391.4	2	3	3	2	2	2	1	2	2	3	1	1	3	1	2	2
PCC-CS391.5	3	3	2	2	1	2	3	-	3	3	2	2	3	2	3	2
Average	2.8	3	2.4	2	1.6	1.8	1.6	1.2	2	2.4	2.2	2	2.2	1.6	2.4	2.2

Subject Code: PCC CS 392	Category: **Professional Core Course**
Subject Name:**Computer Organization**	Semester: III
L-T-P: **3-0-0**	Credit:**3**

Computer Organization

PCC CS-302

Pre-Requisite:

1.Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures.

2. Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming.

3. Boolean Algebra.

Course Objective :

4. To prepare students to perform the analysis and design of various digital electronic circuits.
5. To know how Computer Systems work & its basic principles
6. To know how I/O devices are being accessed and its principles etc

Course Outcome:

At the completion of the course, students will be able to…

CO1: Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.
CO2: Understand basic structure of different combinational circuits multiplexer,decoder, encoder etc.
CO3: Perform different operations with sequential circuits.
CO4: Understand memory and I/O operations& design of ALU.

Experiment No	**Description of Topic**	**Contact Hrs.**
1	Laboratory Experiments: 1 Familiarity with IC-chips: a) Multiplexer, b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data-book.	4
2	Design an Adder/Subtractor composite unit	4
3	Design a BCD adder	4
4	Design of a ‘Carry-Look-Ahead’ Adder circuit	4
5	Use a multiplexer unit to design a composite ALU	4
6	Use ALU chip for multibit arithmetic operation	4
7	Implement read write operation using RAM IC 8	4
8	8. (a) & (b) Cascade two RAM ICs for vertical and horizontalexpansion.	4

Program Outcomes POs of C.S.E. Department:

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PO3 :	**DESIGN / DEVELOPMENT OF SOLUTIONS:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the Public health and safety, and the cultural, societal, and environmental considerations.
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PO5 :	**MODERN TOOL USAGE:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.
PO6 :	**THE ENGINEER AND SOCIETY:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice.
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PO12 :	**LIFE-LONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in Independent and life-Long learning in the broadest context of technological change.

<u>Subject Code: PCC CS 392(Computer Organization)</u>

Subject Code: PCC-CS393	Category: Computer Science Course
Subject Name: IT Workshop (Python)	Semester: III
L-T-P: 0-0-4	Credit:2

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC CS 302.1	3	3	2	2		1	2						1	2	2	1
PCC CS 302.2	3	3											2	1	2	2
PCC CS 302.3	2	1	3	3	3				1				1	1	1	1
PCC CS 302.4	3	2	3	2	2	2	2		1		2	2	1	1	1	2
Average	2.8	2.3	2	1.8	1.3	.8	1	0	.5	0	.5	.5	1.3	1. 3	1.	1.5

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Computer Science and Engineering

Module No	Description of Topic	Contact Hrs.
1	Introduction History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator	--

2	Conditional Statements If, If- else, Nested if-else, Looping, For, While, Nested loops	-
3	Control Statements Break, Continue, Pass	-
4	String Manipulation Accessing Strings, Basic Operations, String slices, Function and Methods	-
5	Lists Introduction, Accessing list, Operations, Working with lists, Function and Methods	-
6	Tuple Introduction, Accessing tuples, Operations, Working, Functions and Methods	-
7	Dictionaries Introduction, Accessing values in dictionaries, Working with dictionaries, Properties	-
8	Functions Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables	-
9	Modules Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions	-
10	Exception Handling Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions. Laboratory Experiments:	-

PROGRAMME OUTCOMES:

Engineering Graduates will be able to,

1. **PO1. Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **PO2. Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **PO3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **PO4. Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **PO5. Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **PO6. The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **PO7. Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **PO8. Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **PO9. Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **PO10. Communication**: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **PO11. Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **PO12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMMEE SPECIFIC OUTCOME (PSOs)

1. PSO1: To learn the concepts and methodologies of computer systems.
2. PSO2: To gain the knowledge of software development life cycles.
3. PSO3: To learn the concepts of recent developments in computer technologies.
4. PSO4: To apply the above knowledge in real life applications.

Pre-Requisite:

- Knowledge of Programming Logic
- Experience with a high level language (C/C++,) is suggested.
  Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Course Objectives:

- To learn and understand Python programming basics and paradigm.
- To learn and understand python looping, control statements and string manipulations.
- Students should be made familiar with the concepts of GUI controls and designing GUI applications.
- To learn and know the concepts of file handling, exception handling
- To develop the ability to write database applications in Python

COURSE OUTCOME (COS)

After completing this course students will be able to,

PCC-CS393.1	To master an understanding of scripting & the contributions of scripting languages
PCC-CS393.2	Design real life problems and think creatively about solutions
PCC-CS393.3	Apply a solution in a program using R/Matlab/Python.
PCC-CS393.4	To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.
PCC-CS393.5	Make database connectivity in python programming language.

CO – PO MATRICES OF COURSES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PCC-CS393.1	3	3	3	3	3	2	1	2	3	3	3	3
PCC-CS393.2	3	3	3	3	3	3	1	3	3	3	3	3
PCC-CS393.3	3	3	3	3	3	3	2	3	3	3	3	3
PCC-CS393.4	3	3	3	3	3	3	2	3	3	3	3	3
PCC-CS393.5	3	3	3	3	3	3	1	2	3	3	3	3
Average	3	3	3	3	3	2.8	1.4	2.6	3	3	3	3

Note:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put"-"

CO – PSOs MATRICES OF COURSES

CO	PSO1	PSO2	PSO3	PSO4
PCC-CS393.1	3	2	2	3
PCC-CS393.2	3	3	2	3
PCC-CS393.3	3	2	3	3
PCC-CS393.4	3	2	2	3
PCC-CS393.5	3	2	3	3
Average	3	2.2	2.4	3

OmDayal Group of Institutions

Department of Computer Science and Engineering

Subject Code: BSc 301	Category: Basic Science Course
Subject Name: Mathematics-III	Semester: **III**
L-T-P: **2-0-0**	Credit:**2**

Course Objectives:

To motivate or challenge students to understand the concept of sequence and series , functions of several variables , multiple integral and 1st and 2nd order differential equation and study the graph theory.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.	8
2	Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems.	7
3	Double and triple integrals (Cartesian and polar), change of order of	8

	integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems.	
4	First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's form, general & singular solution. Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation.	9
5	Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree.	8

Course Outcomes:

1. To learn and to check the convergence of the infinite series.
2. To understand and apply the concept of function of several variables.
3.To implement multiple integrals and solve the different types problems of multiple integral.
4. To understand and to solve Ordinary Differential Equations.
5. To understand the concept of Graph and trees

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSC301.CO1	2	3	2	3	_	_	_	_	_	_	_	3
BSC301.CO2	2	2	3	3	_	_	_	_	_	_	_	3
BSC301.CO3	2	3	3	3	_	_	_	_	_	_	_	3
BSC301.CO4	3	3	3	3	_	_	_	_	_	_	_	3

BSC301.CO5	_	2	2	3	_	_	_	_	_	_	_	3
Average	2.25	2.6	2.6	3	_	_	_	_	_	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Basic Science and Humanities

Subject Code: **HSMC301**	Category: **Mandatory Courses**
Subject Name: **Economics for Engineers**	Semester: III
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1 Understand the role and scope of Engineering Economics and the process of economic decision making

2 Understand the different concepts of cost and different cost estimation techniques

3	Familiarization with the concepts of cash flow, time value of money and different interest formulas
4	Appreciation of the role of uncertainty in future events and using different concepts from probability to deal with uncertainty
5	Understand the concepts of Depreciation and Replacement analysis along with their methods of calculation
6	Familiarization with the phenomenon of inflation and the use of price indices in engineering Economics
7	Introduction to basic concepts of Accounting and Financial Management

Course Content:

Module No	Description of Topic	Contact Hrs.
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - PerUnit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	9
2	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal& Effective Interest. 4. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks.	9
3	5. Inflation and Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. 6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. 7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.	9
	8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances. 9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.	9

	10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	

Course Outcomes:

HSMC-301.1 Make different economic decisions and estimate engineering costs by applying different cost estimation models. Create cash flow diagrams for different situations and use different interest formulae to solve associated problems.

HSMC-301.2Take decisions regarding different engineering projects by using various criteria like rate of return analysis, present worth analysis, cost-benefit analysis etc.Incorporate the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation.

HSMC-301.3 Understand the concepts of depreciation and replacement analysis and solve associated problems.

HSMC-301.4 Understand the process of inflation and use different price indices to adjust for its effect.

HSMC-301.5 Apply the various concepts of Accounting like balance sheet and ratio analysis. Understand the scope of Finance and the role of financial planning and management.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HSMC301.CO1	2	3	-	-	-	1	-	-	-	-	1	2
HSMC301.CO2	2	3	1	-	-	1	-	-	-	-	1	2
HSMC301.CO3	2	3	2	-	-	-	-	-	-	-	2	2
HSMC301.CO4	2	3	1	-	-	-	-	2	-	-	-	2
HSMC301.CO5	2	3	2	2	-	2	-	1	-	-	2	2

Average	2	3	1.2	.4	-	.8	-	.6	-	-	1.2	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

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Department of Computer Science and Engineering

Subject Code: PCC-CS401	Category: Professional core courses
Subject Name: Discrete Mathematics	Semester: **IV**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

To motivate or challenge students to understand the concept the different, set, relation , group theory , basic counting theory ,propositional logic and syntax and solve the different types of problems of Graph theory.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well- Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.	8
2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination	
3	Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.	8
4	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral	7

	Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	
5	Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances	8

Course Outcomes:

On completion of the course students will be able to: -

1. Express a logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution for a given problem using deductive logic and prove the solution on based of a logical inference.
3. Classify its algebraic structure for a given a mathematical problem.
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
5. Develop the given problem as graph networks and solve with techniques of graph theory.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PCC CS401.CO1	_	3	3	3	_	1	_	_	_	_	_	3
PCC CS401.CO2	_	2	3	3	_	_	_	_	_	_	_	3
PCC CS401.CO3	_	3	1	3	_	_	_	_	_	_	_	3
PCC CS401.CO4	_	3	3	3	_	2	_	_	_	_	_	3
PCC CS401.CO5	_	3	3	3	_	2	_	_	_	_	_	3
Average	_	2.8	2.6	3	_	1.67	_	_	_	_	_	3

Subject Code: **PCC CS 402**	Category: **Professional Core Course**
Subject Name:**Computer Architecture**	Semester: IV
L-T-P: **3-0-0**	Credit:4

Computer Architecture

PCC CS 402

Pre-Requisite:

1. The hardware based design has been done in the Analog & DigitalElectronics laboratory
2. Computer Organization laboratory

Course Objective

1. To learn the basics of stored program concepts.
2. To learn the principles of pipelining
3. To learn mechanism of data storage
4. To distinguish between the concepts of serial, parallel, pipeline architecture.

Course Outcome:

At the completion of the course, students will be able to…

CO1: Use various metrics to calculate the performance of a computer system
CO2: Identify the addressing mode of instructions
CO3: Determine which hardware blocks and control lines are used for specific instructions
CO4: Analyse clock periods, performance, and instruction throughput of single-cycle, multicycle, and pipelined implementations of a simple instruction set.
CO5: Detect pipeline hazards and identify possible solutions to those hazards.
.

Course Content :

Module No	Description of Topic	Contact Hrs.
1	HDL introduction	4
2	Basic digital logic base programming with HDL	4

3	8-bit Addition, Multiplication, Division	4
4	8-bit Register design.	4
5	Memory unit design and perform memory operations	4
6	8-bit simple ALU design	4
7	8-bit simple CPU design	4
8	8-bit simple CPU design 8 Interfacing of CPU and Memory	4

Program Outcomes POs of C.S.E. Department:

PO1 :	**ENGINEERING KNOWLEDGE**: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.
PO2 :	**PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 :	**DESIGN / DEVELOPMENT OF SOLUTIONS:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the Public health and safety, and the cultural, societal, and environmental considerations.
PO4 :	**CONDUCT INVESTIGATIONS OF Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 :	**MODERN TOOL USAGE:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.
PO6 :	**THE ENGINEER AND SOCIETY:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice.
PO7 :	**ENVIRONMENT AND SUSTAINABILITY**: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 :	**ETHICS:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 :	**INDIVIDUAL AND TEAMWORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.
PO10 :	**COMMUNICATION:** Communicate effectively on complex engineering

	activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 :	**PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
PO12 :	**LIFE-LONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in Independent and life-Long learning in the broadest context of technological change.

Course name: PCC CS 402 (Computer Architecture)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC CS 402.1	1	1	2	3	2	1	2	1	2	1	1	2	1	2	2	1
PCC CS 402.2	2	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
PCC CS 402.3	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1
PCC CS 402.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
PCC CS 402.5	3	2	2	2	2	1	1	0	1	2	2	1	1	2	2	2
Average	1.6	1.5	1.8	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

1: Slightly 2: Moderately 3: Substantially

PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: To learn the concepts and methodologies of computer systems.

PSO2: To gain the knowledge of software development life cycles.

PSO3: To learn the concepts of recent developments in computer technologies.

PSO4: To apply the above knowledge in real life applications.

Course Name: Formal Language & Automata Theory (PCC-CS403)

Subject Code: PCC-CS403	Category: Professional Core Courses
Subject Name: Formal Language & Automata Theory	Semester: 4^{th}
L-T-P: 3-1-0	Credit:3

Course Objectives:

1	Be able to construct finite state machines and the equivalent regular expressions.
2	Beabletoprovetheequivalenceoflanguagesdescribedbyfinitestatemachines and regular expressions
3	Be able to construct push down automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by push down automata and context free grammars.
4	Be able to construct Turing machines and Post machines. Beabletoprovetheequivalenceoflanguagesdescribedby Turingmachinesand Post machines

Course Content:

Unit	Content	Hrs/Unit

1	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	6
2	Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)	7
3	Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms,	6
	nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down auto mata, closure properties of CFLs.	
4.	Context-sensitive languages: Context-sensitive grammars(CSG)and languages, linear bounded automata and equivalence with CSG.	6
5	Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines	6
6	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages ,reduction between languages and Rices theorem, undecidable problems about languages	6

Course Outcomes (COs)

After completion of this course, the students would be able to:

PCC-CS403.1 write formal notation for strings, languages, and machines.

PCC-CS403.2 design finite automata and determine a language is regular or not.

PCC-CS403.3 design push down automata and context free grammar to generate string of context free languages.

PCC-CS403.4 design Turing machine.

PCC-CS403.5 distinguish between computability, non-computability, decidability, and non-decidability.

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PCC-CS403.1	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	2
PCC-CS403.2	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1
PCC-CS403.3	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1
PCC-CS403.4	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1
PCC-CS403.5	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1
Average	3	3	1	1	1	-	-	-	3	3	-	1	3	-	1	1.2

1. Slightly 2. Moderately 3. Substantially

OmDayal Group of Institutions

Department of Computer Sc Engineering

Subject Code: **PCC-CS404**	Category: **Professional Core courses**
Subject Name: Design and Analysis of Algorithms	Semester: **IV**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them.
2. Through the complexity measures, different range of behaviours of algorithms and the notion of tractable and intractable problems will be understood.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behaviour; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem	8
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6
4	Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P,NP, NP- complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques	10
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	4

Course Outcomes:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms

2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

4. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

5. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

Course Name: PCC-CS404 (Design and Analysis of Algorithms)

CO/PO -PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4

PCC-CS404.1	1	1	3	3	2	1	2	1	2	1	1	2	1	2	2	1
PCC-CS404.2	2	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
PCC-CS404.3	2	1	3	1	2	1	1	1	1	1	2	2	1	1	1	1
PCC-CS404.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
PCC-CS404.5	1	2	3	2	2	0	1	0	1	2	2	1	1	2	2	2
Average	1.5	1.5	2.6	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

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Department of Computer Sc Engineering

Subject Code: **PCC-CS494**	Category: **Professional Core courses**
Subject Name: Design and Analysis of Algorithms Lab	Semester: **IV**
Practical: **4 hrs./week**	Credit:**2**

Course Objectives:

1. The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them.
2. Through the complexity measures, different range of behaviours of algorithms and the notion of tractable and intractable problems will be understood.

Course Content:

Module No	Description of Topic	Contact

		Hrs.
1: Divide & Conquer	1. Implementing binary search, Merge & quick sort, 2. Find Maximum and Minimum element from a array of integer using Divide and Conquer approach, 3. Find the minimum number of scalar multiplication needed for chain of matrix, 4. Implement all pair of Shortest path for a graph (Floyed-Warshall Algorithm) 5. Implement Traveling Salesman Problem, Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm	12
2: Backtracking	6. Implement 8 Queen problem 7. Graph Colouring Problem 8. Hamiltonian Problem	8
3 (Greedy method)	9. Knapsack Problem Job sequencing with deadlines 10. Minimum Cost Spanning Tree by Prim's Algorithm 11. Minimum Cost Spanning Tree by Kruskal's Algorithm	8
4: (Graph traversal algorithm)	12. Implement Breadth First Search (BFS) 13. Implement Depth First Search (DFS)	5

Course Outcomes:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms

2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

4. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

5. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

Course Name: PCC-CS404 (Design and Analysis of Algorithms)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4

PCC-CS404.1	1	1	3	3	2	1	2	1	2	1	1	2	1	2	2	1
PCC-CS404.2	2	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
PCC-CS404.3	2	1	3	1	2	1	1	1	1	1	2	2	1	1	1	1
PCC-CS404.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
PCC-CS404.5	1	2	3	2	2	0	1	0	1	2	2	1	1	2	2	2
Average	1.5	1.5	2.6	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

Subject Code: **PCC CS 492**	Category: **Professional Core Course**
Subject Name:**Computer Architecture**	Semester: IV
L-T-P: **3-0-0**	Credit:4

Computer Architecture

PCC CS 402

Pre-Requisite:

3. The hardware based design has been done in the Analog & Digital Electronics laboratory
4. Computer Organization laboratory

Course Objective

5. To learn the basics of stored program concepts.
6. To learn the principles of pipelining
7. To learn mechanism of data storage
8. To distinguish between the concepts of serial, parallel, pipeline architecture.

Course Outcome:

At the completion of the course, students will be able to…

CO1: Use various metrics to calculate the performance of a computer system
CO2: Identify the addressing mode of instructions
CO3: Determine which hardware blocks and control lines are used for specific instructions
CO4: Analyse clock periods, performance, and instruction throughput of single-cycle, multi cycle, and pipelined implementations of a simple instruction set.
CO5: Detect pipeline hazards and identify possible solutions to those hazards.
.

Course Content :

Module No	**Description of Topic**	**Contact Hrs.**
1	HDL introduction	4
2	Basic digital logic base programming with HDL	4
3	8-bit Addition, Multiplication, Division	4
4	8-bit Register design.	4
5	Memory unit design and perform memory operations	4
6	8-bit simple ALU design	4
7	8-bit simple CPU design	4
8	8-bit simple CPU design 8 Interfacing of CPU and Memory	4

Program Outcomes POs of C.S.E. Department:

PO1 :	**ENGINEERING KNOWLEDGE**: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2 :	**PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 :	**DESIGN / DEVELOPMENT OF SOLUTIONS:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the Public health and safety, and the cultural, societal, and environmental considerations.
PO4 :	**CONDUCT INVESTIGATIONS OF Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 :	**MODERN TOOL USAGE:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.
PO6 :	**THE ENGINEER AND SOCIETY:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice.
PO7 :	**ENVIRONMENT AND SUSTAINABILITY**: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 :	**ETHICS:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 :	**INDIVIDUAL AND TEAMWORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.
PO10 :	**COMMUNICATION:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 :	**PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
PO12 :	**LIFE-LONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in Independent and life-Long learning in the broadest context of technological change.

Course name: PCC CS 402 (Computer Architecture)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC CS 402.1	1	1	2	3	2	1	2	1	2	1	1	2	1	2	2	1
PCC CS 402.2	2	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
PCC CS 402.3	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1
PCC CS 402.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
PCC CS 402.5	3	2	2	2	2	1	1	0	1	2	2	1	1	2	2	2
Average	1.6	1.5	1.8	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

OmDayal Group of Institutions

Department of Chemistry

Course Code : BSC401	**Category :** Basic Science Courses
Course Title : **Biology**	**Semester** : Fourth
Contacts:2L+1T	**Credit:3**

Course Objectives:

To introduce modern biology with an emphasis on evolution of biology as a multi-disciplinary field and to make students aware of application of engineering principles in biology and engineering robust solution inspired by biological examples.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction** Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry	2
2	**Classification:** Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructureprokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus.	3
3	**Genetics** Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4
4	**Biomolecules** Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can	4

	imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	
5	**Enzymes** Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	4
6	**Information Transfer** Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	4
7	**Macromolecular analysis:** Purpose: To analyze biological processes at the reductionistic level. Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5
8	**Metabolism** Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4
9	**Microbiology** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3

Course Outcomes:

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring and identify DNA as a genetic material in the molecular basis of information transfer.
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine and analyse biological processes at the reductionistic level
5. Classify enzymes and distinguish between different mechanisms of enzyme action.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSC401.CO1	2	-	-	-	2	2	_	_	_	_	_	3
BSC401.CO2	1	2	-	-	1	2	3	-	-	-	-	3
BSC401.CO3	1	3	2	-	2	2	3	-	-	-	-	3
BSC401.CO4	-	2	-	-	1	1	2	-	-	-	-	3
BSC401.CO5	2	2	1	-	-	2	2	-	-	-	-	3
Average	1.5	2.25	1.5	-	1.5	1.8	2.5	-	-	-	-	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

<u>OmDayal Group of Institutions</u>
Department of Chemistry

Subject Code: **MC- 401**	Category: Basic Science Courses
Subject Name: **Environmental Science**	Semester: **IV**
Duration: 6 months	Credit:**1**

Course Objectives:
The students will be able to understand the environment and its relationships with human activities and apply the fundamental knowledge of science and engineering to assess environmental and health risk. It will also help students to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues and acquire the skill to solve problem related to environment and pollution

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering	06
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]	06

	Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.	
3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).	11
4	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical	09

PO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12

	effects: Lead, Mercury, Cadmium, and Arsenic	
5	Lithosphere; Internal structure of earth, rock and soil Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).	03
6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control	03
7	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.	02

Course Outcomes:

After completion of this course, the learners will be able to

1. understand the natural environment and its relationships with human activities
2. apply the fundamental knowledge of science and engineering to assess environmental risk
3. apply the fundamental knowledge of science and engineering to assess health risk
4. develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations
5. acquire skills for scientific problem-solving related to air, water, noise & land pollution.

MC-401.CO1	-	2	-	-	-	3	3	3	_	_	_	3
MC-401.CO2	1	-	-	-	-	3	3	3	-	-	-	3
MC-401.CO3	-	1	-	-	-	3	3	3	-	-	-	3
MC-401.CO4	-	2	-	-	-	3	3	3	-	-	-	3
MC-401.CO5	1	2	2	-	2	3	3	3	-	-	-	3
Average	1	1.75	2	-	2	3	3	3	-	-	-	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

<u>OmDayal Group of Institutions</u>
Department of Computer Science & Engineering

Subject Code: ESC 501	Category: **Engineering Science Course**
Subject Name:**Software Engineering**	Semester: **V**
L-T-P: **3-0-0**	Credit:**3**

Software Engineering

ESC 501

Pre-Requisite:

1. An understanding of basic computer software .

2. Object Oriented programming skills.

3.UML concept

Course Outcome:

At the completion of the course, students will be able to…

CO1: Identifying the key activities in Software Engineering and compare different process models.
CO2: Identifying different software project planning activities.
CO3: Systematic approaches of software requirements analysis and specification, and software
design.
CO4: Different approaches of software coding, documentation and testing.
CO5: Concepts of software quality, software maintenance and configuration management.

Course Content :

Module No	**Description of Topic**	**Contact Hrs.**
1	Overview of System Analysis &Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analys.is, COCOMO model	10
2	System Design – Context diagram and DFD, Problem Partitioning, Top-Down And Bottom-Up design; Decision tree, decision table and structured English; Functional vs. Object- Oriented approach.	5
3	Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification 12 Metrics, Monitoring & Control.	12
4	Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.	7
5	Static and dynamic models, why modelling, UML diagrams: Class	10

	diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram.	

Program Outcomes POs of C.S.E. Department:

PO1 :	**ENGINEERING KNOWLEDGE**: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.
PO2 :	**PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 :	**DESIGN / DEVELOPMENT OF SOLUTIONS:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the Public health and safety, and the cultural, societal, and environmental considerations.
PO4 :	**CONDUCT INVESTIGATIONS OF Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 :	**MODERN TOOL USAGE:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.
PO6 :	**THE ENGINEER AND SOCIETY:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice.
PO7 :	**ENVIRONMENT AND SUSTAINABILITY**: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 :	**ETHICS:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 :	**INDIVIDUAL AND TEAMWORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.
PO10 :	**COMMUNICATION:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 :	**PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
PO12 :	**LIFE-LONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in Independent and life-Long learning in the broadest context of technological change.

course name: ESC 501 (Software Engineering)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ESC 501.1	1	1	2	3	2	1	2	1	2	1	1	2	1	2	2	1
ESC 501.2	2	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
ESC 501.3	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1
ESC 501.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
ESC 501.5	3	2	2	2	2	1	1	0	1	2	2	1	1	2	2	2
Average	1.6	1.5	1.8	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

OmDayal Group of Institutions

Department ofComputer Science & Engineering

Subject Code: **PCC-CS 501**	Category: **Professional Core courses**
Subject Name: **Compiler Design**	Semester: **V**
L-T-P: **3-1-0**	Credit:**3**

Course Objectives:

The Objectives of this course is to explore the principles, algorithms, and data structures involved in the design and construction of compilers. Topics include context-free grammars, lexical analysis, parsing techniques, symbol tables, error recovery, code generation, and code optimization.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to Compiling: Compilers, Analysis of the source program, The phases of the compiler, Cousins of the co	3
2	The role of the lexical analyser, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyser generator (Lex).	6
3	The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Nonrecursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator	9

	precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques	
4	Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.	5
5	Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions	4
6	Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.	5
7	Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples)	4
8	Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimi	5
9	Issues in the design of code generator, a simple code generator, Register allocation & assignment	4

Course Outcomes:

1. Understand compilation concept and its different phases.
2. Understand the techniques to remove ambiguity from a grammar.
3. Design Parse Trees and Context Free Grammars
4. Understanding different parsing techniques.
5. Code Generation and code optimization techniques.
6. **PROGRAM SPECIFIC OUTCOMES (PSO)**

PSO 1	To learn the concepts and methodologies of computer systems.
PSO 2	To gain the knowledge of software development life cycles.
PSO 3	To learn the concepts of recent developments in computer technologies.
PSO 4	To apply the above knowledge in real life applications.

	PO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO1**	**PO1**	**PO1**	**PSO**	**PS**	**PSO**	**PS**

	1	2	3	4	5	6	7	8	9	0	1	2	1	O 2	3	O 4
PCC -CS 501.1	3	1	-	-	1	1	-	-	3	3	3	2	4	-	3	2
PCC -CS 501.2	3	2	-	1	-	-	3	2	1	3	3	3	3	-	3	4
PCC -CS 501.3	3	1	1	-	1	1	3	2	3	3	3	2	3	-	4	4
PCC -CS 501.4	3	3	2	-	3	2	3	2	3	3	3	3	4	-	3	4
PCC -CS 501.5	3	3	2	-	3	2	3	2	3	3	3	3	3	-	4	4
AVG	3	2	1	0.2	1.6	1.2	2.4	1.6	2.6	3	3	2.6	3.4	-	3.4	3.6

OmDayal Group of Institutions
Department of Computer Science and Engineering

Subject Code: PCC-CS502	Category: Computer Science Course
Subject Name: OPERATING SYSTEM	Semester: V
L-T-P: 3-0-0	Credit:2

Module No	Description of Topic	Contact Hrs.
1	**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	**3**
2	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	**10**
3	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	**5**
4	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	**5**
5	**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation–Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty	**8**

	page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).	
6	**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	**6**

PROGRAMME OUTCOMES:

Engineering Graduates will be able to,

1. **PO1. Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **PO2. Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **PO3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **PO4. Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **PO5. Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **PO6. The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **PO7. Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **PO8. Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and
   norms of the engineering practice.

9. **PO9. Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **PO10. Communication**: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive
clear instructions.
11. **PO11. Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **PO12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMMEE SPECIFIC OUTCOME (PSOs)

1. PSO1: To learn the concepts and methodologies of computer systems.
2. PSO2: To gain the knowledge of software development life cycles.
3. PSO3: To learn the concepts of recent developments in computer technologies.
4. PSO4: To apply the above knowledge in real life applications.

Objective:

- To learn the mechanisms of OS to handle processes and threads and their communication
- To learn the mechanisms involved in memory management in contemporary OS
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
- To know the components and management aspects of concurrency management

<u>PREREQUISITE:</u>

- Computer Organization &Architecture

COURSE OUTCOME (COS)

After completing this course students will be able to,

PCC-CS502.1	Describe the main components of a computer and understand how these are managed by the operating system.

PCC-CS502.2	Demonstrate the concepts, structure and design of operating systems and its impact on application system design and performance
PCC-CS502.3	Demonstrate competence in recognizing and using operating system features
PCC-CS502.4	Discuss the issues involved in the management and security of an operating system.
PCC-CS502.5	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement file management system

CO – PO MATRICES OF COURSES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PCC-CS502.1	3	2	2	2	3	1	3	2	1	3	2	2
PCC-CS502.2	3	3	2	3	3	2	3	2	1	2	3	2
PCC-CS502.3	2	3	3	3	2	1	3	2	2	3	3	2
PCC-CS502.4	2	2	2	3	3	3	3	3	2	2	3	3
PCC-CS502.5	2	2	2	3	3	3	3	3	2	2	2	2
Average	2.4	2.4	2.2	2.8	2.8	2	3	2.4	1.6	2.4	2.6	2.5

Note:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put“-”

CO – PSOs MATRICES OF COURSES

CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**
PCC-CS502.1	3	2	2	3

PCC-CS502.2	3	3	2	3
PCC-CS502.3	3	2	3	3
PCC-CS502.4	3	2	2	3
PCC-CS502.5	3	2	3	3
Average	3	2.2	2.4	3

Course Name: Object Oriented Programming (PCC-CS503)

Subject Code: PCC-CS503	Category: Professional Core Courses
Subject Name:Object Oriented Programming	Semester:5^{th}
L-T-P: 3-0-0	Credit:3

Course Objectives: To learn the concept of Object Oriented Programming and develop object oriented programs using Java.

Course Content:

Unit	Content	Hrs/Unit
1	Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, Abstraction function. Implementing operations, illustrated by the Text example.	8
2	Features of object-oriented programming. Encapsulation, objectidentity, polymorphism–but not inheritance.	8
3	Inheritance in design. Design patterns. Introduction and classification. The iterator pattern.	6
4	Model-view-controller pattern. Commands as methods and a subjects. Implementing OO language features. Memory management.	6

5	Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process	6

Course Outcomes (COs)

After completion of this course, the students would be able to:

PCC-CS503.1 specify simple abstract data types and design implementations, using abstraction function to document them.

PCC-CS503.2 recognize features of object oriented design such as encapsulation, inheritance, polymorphism, and composition of systems.

PCC-CS503.3 Name and apply some common object oriented design pattern and give examples of their use.

PCC-CS503.4 to learn model view architecture.

PCC-CS503.5 Design applications with some event driven graphical user interface.

Mapping between CO and PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	P
PCC-CS503.1	3	3	2	2	2	-	-	-	2	2	1	1	2	2	2
PCC-CS503.2	3	3	2	2	2	-	-	-	2	2	1	1	2	2	2
PCC-CS503.3	3	2	3	2	2	-	-	-	2	2	1	1	2	2	2
PCC-CS503.4	3	2	3	2	2	-	-	-	2	2	1	1	2	2	2
PCC-CS503.5	3	2	3	2	3	-	-	-	2	2	1	1	2	2	2
Average	3	2.4	2.6	2	2.2	-		-	2	2	1	1	2	2	2

Subject Code: **PEC-IT-501B**	Category: **Professional Elective courses**
Subject Name: **Artificial intelligence**	Semester: **V**
L-T-P: **3-0-0**	Credit:**4**

Course Objectives:

1. To provide a strong foundation of fundamental concepts in Artificial Intelligence
2. To provide a basic exposition to the goals and methods of Artificial Intelligence
3. To enable the student to apply these techniques in applications which involve perception, reasoning and learning.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction: Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving : Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	6
2	Search techniques: Solving problems by searching : problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies: Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening	13
3	Knowledge & reasoning : Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	6
4	Using predicate logic: Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural-deduction. Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	6
5	Natural Language processing : Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. Learning: Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. Expert Systems : Representing and using domain knowledge, expert system shells, knowledge acquisition.	9

Course Outcomes:

1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.

2. Apply these techniques in applications which involve perception, reasoning and learning.

3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.

4. Acquire the knowledge of real world Knowledge representation.

5. Analyze and design a real world problem for implementation and understand the dynamic behaviour of a system and use different machine learning techniques to design AI machine and enveloping applications for real world problems.

Course Name: PEC-IT-501B (Artificial intelligence)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PEC-IT-501B.1	1	1	2	3	2	1	2	1	2	1	1	2	1	2	2	1
PEC-IT-501B.2	2	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
PEC-IT-501B.3	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1
PEC-IT-501B.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
PEC-IT-501B.5	3	2	2	2	2	1	1	0	1	2	2	1	1	2	2	2
Average	1.6	1.5	1.8	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

Subject Code: ESC 591	Category: **Engineering Science Course**
Subject Name:**Software Engineering Lab**	Semester: **V**
L-T-P: 4**-0-0**	Credit:2

Software Engineering

ESC 591

Pre-Requisite:

1. An understanding of basic computer software .

2. Object Oriented programming skills.

3.UML concept

Course Outcome:

At the completion of the course, students will be able to…

CO1: To understand the software engineering methodologies involved in the phases for project development.
CO2: To gain knowledge about open source tools used for implementing software engineering methods.
CO3:3 To exercise developing product-startups implementing software engineering methods.
CO4 Learn simple optimization techniques.
.
Course Content :

Module No	Description of Topic	Contact Hrs.
1	Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure	4
2	Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.	4
3	.DataModeling – Use work products – data dictionary.	4
4	Software Designing - Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.	4
5	Prototype model – Develop the prototype of the product. The SRS and prototype model should be submitted for end semester examination.	4

Program Outcomes POs of C.S.E. Department:

PO1 :	**ENGINEERING KNOWLEDGE**: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.
PO2 :	**PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3 :	**DESIGN / DEVELOPMENT OF SOLUTIONS:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the Public health and safety, and the cultural, societal, and environmental considerations.
PO4 :	**CONDUCT INVESTIGATIONS OF Complex Problems:** Use research-

	based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 :	**MODERN TOOL USAGE:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.
PO6 :	**THE ENGINEER AND SOCIETY:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice.
PO7 :	**ENVIRONMENT AND SUSTAINABILITY**: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 :	**ETHICS:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 :	**INDIVIDUAL AND TEAMWORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.
PO10 :	**COMMUNICATION:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 :	**PROJECT MANAGEMENT AND FINANCE:** Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
PO12 :	**LIFE-LONG LEARNING:** Recognize the need for, and have the preparation and ability to engage in Independent and life-Long learning in the broadest context of technological change.

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ESC 591.1	1	1		3	2	1		1	2	1	1	2	1	2		1
ESC 591.2	2	2	2	1	3	2	1	0	1		1		2	1	2	2
ESC 591.3	1		1	1	2	1		1	1	1	2		1	1	1	1
ESC 591.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
Average	1.3	0.8	1.3	2	2.2	1	0.5	0.5	1.5	1	1.3	.8	1.3	1.4	1	1.5

OmDayal Group of Institutions
Department of Computer Science and Engineering

Subject Code: PCC-CS592	Category: Computer Science Course
Subject Name: OPERATING SYSTEM LAB	Semester: V
L-T-P: 0-0-4	Credit:2

Module No	Description of Topic	Contact Hrs.

1	1 1. Managing Unix/Linux Operating System [8P]: Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups.	8P
2	Process [4P]: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.	4P
3	Signal [4P]: signal handling, sending signals, signal interface, signal sets.	4P
4	Signal [4P]: signal handling, sending signals, signal interface, signal sets. 4. Semaphore [6P]: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v). POSIX Threads [6P]: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)	4P
5	POSIX Threads [6P]: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit,pthread_attr_init, pthread_cancel)	6P
6	6. Inter-process communication [6P]: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).	6P

PROGRAMME OUTCOMES:

Engineering Graduates will be able to,

13. **PO1. Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
14. **PO2. Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
15. **PO3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

16. **PO4. Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
17. **PO5. Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
18. **PO6. The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
19. **PO7. Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
20. **PO8. Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
21. **PO9. Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
22. **PO10. Communication**: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive
clear instructions.
23. **PO11. Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
24. **PO12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMMEE SPECIFIC OUTCOME (PSOs)

5. PSO1: To learn the concepts and methodologies of computer systems.
6. PSO2: To gain the knowledge of software development life cycles.
7. PSO3: To learn the concepts of recent developments in computer technologies.
8. PSO4: To apply the above knowledge in real life applications.

Prerequisite:

Knowledge in Computer Organization

Course Objectives:

- Understand Functions, Services and structure of Operating Systems.
- Understand processes, threads, schedulers and explanation of CPU scheduling.
- Understand issues related to Process Synchronization and focus on principles of

Deadlock and related problems

- Comprehend the mechanisms used in Memory Management and Virtual Memory.
- Understand the concepts of File System, secondary storage management and Disk Scheduling

COURSE OUTCOME (COS)

After completing this course students will be able to,

PCC-CS592.1	Analyze basic concepts of operating system and their structures
PCC-CS592.2	Analyze various issues related to inter process communication like process scheduling, resource management and deadlocks.
PCC-CS592.3	Demonstration of memory management algorithms
PCC-CS592.4	Synthesize the concepts of I/O management, file system implementation and problems related to security and protection
PCC-CS592.5	Awareness of computational issues, resources in distributed environment

CO – PO MATRICES OF COURSES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PCC-CS592.1	3	3	3	3	3	1	1	2	1	1	3	3
PCC-CS592.2	3	3	3	3	3	1	2	2	2	1	2	2
PCC-CS592.3	3	3	3	3	3	1	1	2	1	2	3	3
PCC-CS592.4	3	3	3	3	3	1	2	3	2	2	3	3
PCC-CS592.5	3	3	3	3	3	1	2	3	2	2	3	3

Average	3	3	3	3	3	1	8	2.2	1.6	1.6	2.8	2.6

Note:
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put"-"

CO – PSOs MATRICES OF COURSES

CO	PSO1	PSO2	PSO3	PSO4
PCC-CS592.1	3	3	3	3
PCC-CS592.2	3	3	2	3
PCC-CS592.3	3	2	3	3
PCC-CS592.4	3	2	2	3
PCC-CS592.5	3	2	3	3
Average	3	2.4	2.6	3

Course Name: Object Oriented Programming Lab (PCC-CS593)

Subject Code: PCC-CS593	Category: Professional Core Courses
Subject Name: Object Oriented Programming Lab	Semester: 5th

L-T-P:0-0-4	Credit:2

Course Objectives: To develop object oriented programs using Java application and GUI based programming.

Course Content:

Unit	Content	Hrs/ Unit
1	Assignmentsonclass,constructor,overloading,inheritance,overriding	8
2	Assignmentsonwrapperclass, arrays, string	8
3	Assignmentsondevelopinginterfaces-multipleinheritance,extendinginterfaces	8
4	Assignmentsoncreatingand accessingpackages, creating multi-threaded programs, creating exceptions	8
5	Assignmentsonappletprogramming, swing	8

Course Outcomes (COs)

After completion of this course, the students would be able to:

PCC-CS593.1to develop programs using different object oriented concepts like inheritance, encapsulation, polymorphism etc.

PCC-CS593.2to develop programs using string and array in Java.

PCC-CS593.3 to develop program related to multiple inheritance using interface.

PCC-CS593.4 to create packages, multi-threaded programs, and exceptions.

PCC-CS593.5to develop graphics programming using applet and swing.

Mapping between CO and PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	P
PCC-CS593.1	1	3	3	1	3	-	-	-	2	2	1	1	1	1	2
PCC-CS593.2	3	3	3	2	3	-	-	-	2	2	1	1	1	1	2
PCC-CS593.3	3	3	3	2	3	-	-	-	2	2	1	1	1	1	2

PCC-CS593.4	3	3	3	2	3	-	-	-	2	2	1	1	1	1	2
PCC-CS593.5	3	3	3	2	3	-	-	-	2	2	1	1	1	1	2
Average	3	3	3	2	3	-		-	2	2	1	1	1	1	2

1. Slightly 2. Moderately 3. Substantially

OmDayal Group of Institutions

Department of Basic Science and Humanities

Subject Code: **HSMC501**	Category: **Professional Core courses**
Subject Name: Introduction to Industrial Management (Humanities III)	Semester: **V**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. To understand basic principles/concepts of:
2. Industrial management and organization;
3. Industrial plant design;
4. Effective material management;
5. Management and resource allocation; and Engineering economy.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction System- concept, definition, types, parameters, variables and behavior. Management – definition and functions. Organization structure: i. Definition. ii. Goals. iii. Factors considered in formulating structure. iv. Types. v. Advantages and disadvantages. vi. Applications. Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management. Organizational culture and climate – meaning, differences and factors affecting them.	6

	Moral-factors affecting moral. Relationship between moral and productivity. Job satisfaction- factors influencing job satisfaction. Important provisions of factory act and labor laws.	
2	Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT): 2.1 CPM & PERT-meaning, features, difference, applications. 2.2 Understand different terms used in network diagram. Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples). Determination of critical path on network. Floats, its types and determination of floats. Crashing of network, updating and its applications.	8
3	Materials Management: Material management-definition, functions, importance, relationship with other departments. Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market.	6
4	Production planning and Control (PPC): Types and examples of production. PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. Scheduling- meaning and need for productivity and utilisation. Gantt chart- Format and method to prepare. Critical ratio scheduling-method and numeric examples. Scheduling using Gantt Chart (for at least 5-7 components having 5-6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. 4.7 Bottlenecking- meaning, effect and ways to reduce.	8
5	Value Analysis (VA) and Cost Control: 5.1 VA-definition, terms used, process and importance. 5.2 VA flow	4

	diagram. DARSIRI method of VA. Case study of VA-at least two. Waste-types, sources and ways to reduce them. Cost control-methods and important guide lines.	
6	Recent Trends in IM: ERP (Enterprise resource planning) - concept, features and applications. Important features of MS Project. Logistics- concept, need and benefits. Just in Time (JIT)-concept and benefits. Supply chain management-concept and benefits.	4

Course Outcomes:

On completion of the course students will be able to

1. Interpret given organization structure, culture, climate and major provisions of factory acts and laws.

2. Explain material requirement planning and store keeping procedure.

3. Plot and analyze inventory control models and techniques.

4. Prepare and analyze CPM and PERT for given activities.

5. List and explain PPC functions.

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
HSMC501.CO1						2	2	3		2		2
HSMC501.CO2	1	2									2	2
HSMC501.CO3		2								1		
HSMC501.CO4	2	2	2						3	3	3	1
HSMC501.CO5	1	2	2				1	1		1	3	
Average	.6	1.6	.8				.6	.8	.6	1.4	1.6	1

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Computer Science & Engineering

Subject Code: PCC-CS601	*Category:* Engineering Science Courses
Subject Name: Database Management Systems	*Semester:* ***VI***
L-T-P: : 3-0-0	*Credit:**3***

Objective:
1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. To understand the different issues involved in the design and implementation of a database system.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	Database system architecture: Data Abstraction, Data Independence, Data Definition Language(DDL),Data Manipulation Language(DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	*9*
2	Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	*13*
3	Storage strategies: Indices, B-trees, hashing	*3*
4	Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi version and optimistic Concurrency Control schemes, Database recovery	*5*
5	Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection	*3*
6	Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining	*3*

CRITERION 3: Course Outcomes and Program Outcomes

3.1 Establish the correlation between the courses and the Program Outcomes (POs)
Program Outcomes:
PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSO)
PSO1: To learn the concepts and methodologies of computer systems.
PSO2: To gain the knowledge of software development life cycles.
PSO3: To learn the concepts of recent developments in computer technologies.
PSO4: To apply the above knowledge in real life applications.
Course Name: Data Base Management System (PCC-CS601):
Course Outcomes

PCC-CS 601.1: Understanding fundamentals of database.
PCC-CS 601.2: Knowing various Data Models.
PCC-CS 601.3: Understanding transactions.
PCC-CS 601.4: Query Optimization.
PCC-CS 601.5: Implementing SQL queries.

Course Name: Database Management System (PCC-CS601):

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PCC-CS601.1	3	3	3	2	2	3	2	3	3	3	3	3	3	3	2	3
PCC-CS601.2	3	3	3	3	2	3	3	2	3	3	3	3	2	1	3	2

PCC-CS601.3	3	-	2	1	-	-	3	-	3	3	2	3	3	3	1	3
PCC-CS601.4	2	2	-	2	3	2	-	3	3	3	-	3	-	2	3	-
PCC-CS601.5	3	3	3	1	3	3	3	2	3	3	3	3	3	-	1	2
Average	2.8	2.2	2.2	1.8	2	2.2	2.2	2	3	3	2.8	3	2.2	1.8	2	2

OmDayal Group of Institutions

Department of Computer Sc Engineering

Subject Code: **PCC-CS602**	Category: **Professional Core courses**
Subject Name: Computer Network	Semester: **VI**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	9
2	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA	8
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.	14
4	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	8
5	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	8

Course Outcomes:

PCC-CS602.1: Recognize the technological trends of Computer Networking.

PCC-CS602.2: Discuss the key technological components of the Network.

PCC-CS602.3: Evaluate the challenges in building networks and solutions to those.

PCC-CS602.4: Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
PCC-CS602.5: Proficient at solving computer networking problems in the workplace

Course Name: PCC-CS602 (Computer Network)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-CS602.1	1	1	2	3	2	1	2	1	2	1	1	2	1	2	2	1
PCC-CS602.2	0	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
PCC-CS602.3	0	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1
PCC-CS602.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
PCC-CS602.5	0	2	2	2	2	0	1	0	1	2	2	1	1	2	2	2
Average	1	1.5	1.8	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

<u>OmDayal Group of Institutions</u>
Computer Science & Engineering

Subject Code: PCC-CS691	*Category:* Engineering Science Courses
Subject Name: Database Management Systems	*Semester:* ***VI***
L-T-P: : 3-0-0	*Credit:**3***

Objective:
1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3. To understand and use data manipulation language to query, update, and manage a database
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. To understand the different issues involved in the design and implementation of a database system.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	Database system architecture: Data Abstraction, Data Independence, Data Definition Language(DDL),Data Manipulation Language(DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	*9*
2	Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	*13*
3	Storage strategies: Indices, B-trees, hashing	*3*
4	Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi version and optimistic Concurrency Control schemes, Database recovery	*5*
5	Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection	*3*
6	Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining	*3*

CRITERION 3: Course Outcomes and Program Outcomes

3.1 Establish the correlation between the courses and the Program Outcomes (POs)
Program Outcomes:
PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and

IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. Communication: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES (PSO)
PSO1: To learn the concepts and methodologies of computer systems.
PSO2: To gain the knowledge of software development life cycles.
PSO3: To learn the concepts of recent developments in computer technologies.
PSO4: To apply the above knowledge in real life applications.
Course Name: Data Base Management System (PCC-CS601):
Course Outcomes

PCC-CS 691.1: Understanding fundamentals of database.
PCC-CS 691.2: Knowing various Data Models.
PCC-CS 691.3: Understanding transactions.
PCC-CS 691.4: Query Optimization.
PCC-CS 601.5: Implementing SQL queries.

Course Name: Database Management System (PCC-CS601):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-CS691.1	3	3	3	2	2	3	2	3	3	3	3	3	3	3	2	3
PCC-CS691.2	2	3	3	3	2	3	3	2	3	3	3	3	2	1	3	2
PCC-CS691.3	3	-	2	1	-	-	3	-	3	3	2	3	3	3	1	3
PCC-CS691.4	2	1	-	2	3	2	-	3	3	3	-	3	-	2	3	-
PCC-CS691.5	3	3	3	1	3	3	3	2	3	3	3	3	3	-	1	3
Average	2.6	2	2.2	1.8	2	2.2	2.2	2	3	3	2.8	3	2.2	1.8	2	2.2

OmDayal Group of Institutions
Department of Computer Sc Engineering

Subject Code: **PCC-CS692**	Category: **Professional Core courses**
Subject Name: Computer Network	Semester: **VI**
Practical: 4hrs/week	Credit:**2**

Course Objectives:
1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To provide an opportunity to do network programming.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	1. NIC Installation & Configuration (Windows/Linux)	4
2	2. Understanding IP address, subnet etc 3. Familiarization with Networking cables (CAT5, UTP) 4. Connectors (RJ45, T-connector) 5. Hubs, Switches	8
3	6. TCP/UDP Socket Programming Simple, TCP based, UDP based 7. Multicast & Broadcast Sockets 8. Implementation of a Prototype Multithreaded Server	12
4	9. Implementation of Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window) 10. Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) 11. Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)	12
5	12. Server Setup/Configuration FTP, TelNet, NFS, DNS, Firewall	4

Course Outcomes:

PCC-CS602.1: Recognize the technological trends of Computer Networking.

PCC-CS602.2: Discuss the key technological components of the Network.

PCC-CS602.3: Evaluate the challenges in building networks and solutions to those.

PCC-CS602.4: Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

PCC-CS602.5: Proficient at solving computer networking problems in the workplace

Course Name: PCC-CS602 (Computer Network)

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PCC-CS602.1	1	1	2	3	2	1	2	1	2	1	1	1	1	1	2	1

PCC-CS602.2	2	2	2	1	3	2	1	0	1	2	1	1	0	1	2	2
PCC-CS602.3	2	1	1	1	2	1	1	1	1	1	2	1	1	1	1	1
PCC-CS602.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
PCC-CS602.5	0	2	2	2	2	0	1	0	1	2	2	1	1	0	2	2
Average	2	1.5	1.8	2	2.2	1	1.3	1	1.5	1.5	1.4	1	1.2	1	1.6	1.6

OmDayal Group of Institutions
Department of Computer Sc Engineering

Subject Code: **PEC-IT601 D**	Category: **Professional Core courses**
Subject Name: Image Processing	Semester: **VI**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study image restoration procedures.
4. To study the image compression procedures.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	9
2	A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.	4
3	Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete	9

	Fourier Transform, Discrete Cosine &SineTransform.	
4	Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. Highpass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8
5	Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation	7
6	Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging	7

Course Outcomes:

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques
7. **PROGRAM SPECIFIC OUTCOMES (PSO)**

PSO 1	To learn the concepts and methodologies of computer systems.
PSO 2	To gain the knowledge of software development life cycles.
PSO 3	To learn the concepts of recent developments in computer technologies.
PSO 4	To apply the above knowledge in real life applications.

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
PEC-IT601 D.1	3	3	-	-	2	-	-	3	2	2	2	1	2	-	4	3
PEC-IT601 D.2	3	3	3	3	2	-	-	1	3	2	2	3	3	-	3	3
PEC-IT601 D.3	3	3	3	2	1	1	1	1	-	-	2	2	3	-	2	3
PEC-IT601 D.4	2	2	1	1	2	-	-	-	2	2	1	-	4	-	3	3
PEC-IT601 D.5	2	2	3	3	3	1	-	-	1	2	2	1	2	-	3	3
AVERAGE	2.6	2.6	2	1.8	2	0.4	0.2	1	1.6	1.6	1.8	1.4	2.8	-	3	3

Name: Data Warehousing & Data Mining (PEC-IT602B)

Subject Code: PCC-IT602B	Category: Professional Elective Courses
Subject Name:Data Warehousing & Data Mining	Semester:6th
L-T-P:3-0-0	Credit:3

Course Objectives: To learn the concepts, design of data warehousing and algorithms of data mining and their real life applications.

Course Content:

Unit	Content	Hrs/Unit
1	Introduction to Data Warehousing; Data Mining :Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;	8
2	Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,	8
3	Mining Time series Data, Periodicity Analysis for timerelatedsequencedata,Trendanalysis,SimilaritysearchinTime-seriesanalysis;	8
4.	Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; GraphMining;SocialNetworkAnalysis;modulationforcommunication,filtering,feedback control systems.	11
5	Web Mining, Mining the web page layout structure, mining web link structure, Mining multimedia data on the web, Automatic classification of web documents And web usage mining; Distributed Data Mining.	9
6	Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis	5

Course Outcomes (COs)

After completion of this course, the students would be able to:

PEC-IT602B.1 design a Data Warehouseand Analyze data of data warehouse using On-Line Analytic Processing (OLAP) operations.

PEC-IT602B.2 learn different data mining techniques like association, clustering, classification etc.

PEC-IT602B.3 learn techniques to extract pattern from time series data and learn trend analysis.

PEC-IT602B.4 learn different techniques of graph and web mining.

PEC-IT602B.5 analyze social network.

Mapping between CO and PO

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PEC-IT602B.1	2	3	3	1	2	-	-	-	1	1	1	1	1	-	3	3
PEC-IT602B.2	2	3	3	3	2	-	-	-	2	2	2	1	1	-	3	3
PEC-IT602B.3	2	3	3	3	2	-	-	-	2	2	2	1	1	-	3	3
PEC-IT602B.4	2	3	3	3	2	-	-	-	2	2	2	1	1	-	3	3
PEC-IT602B.5	2	3	3	3	2	-	-	-	2	2	2	1	1	-	3	3
Average	2	3	3	2.6	2	-	-	-	2	2	2	1	1	-	3	3

1. Slightly 2. Moderately 3. Substantially

OmDayal Group of Institutions

Department ofComputer Science and Engineering

Subject Code: OEC-IT601A	Category: Open elective courses
Subject Name: Numerical Methods	Semester: **VI**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

To motivate or challenge students to understand the concepts of different types of numerical error, interpolation, numerical integration ,numerical differentiation and solve the different types of algebraic equations.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Approximation in numerical computation:** Truncation and rounding errors, Fixed and floatingpoint arithmetic, Propagation of errors.	2
2	**Interpolation:** Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	8
3	**Numerical integration:** Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.	3
4	**Numerical solution of a system of linear equations:** Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.	8
5	**Numerical solution of Algebraic equation:** Bisection method, Regula-Falsi method, Newton-Raphson method.	3
6	**Numerical solution of ordinary differential equation:** Euler's method, Runge-Kutta methods, PredictorCorrector methods and Finite Difference method.	2

Course Outcomes:

1. Understand the concept of errors in computation.
2. To learn the method of interpolation to find out the functional value at a point other than the given points.
3. To integrate and to find the solution of ODE for complex cases.
4. To solve the transcendental equations having infinite roots.

5. To solve a systems of linear equations with decimal coefficients

PO / *CO*	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OEC-IT601A.CO1	_	1	2	2	_	_	_	_	_	_	_	3
OEC-IT601A.CO2	_	3	2	2	_	_	_	_	_	_	_	3
OEC-IT601A.CO3	_	3	2	2	_	_	_	_	_	_	_	3
OEC-IT601A.CO4	_	3	2	2	_	_	_	_	_	_	_	3
OEC-IT601A.CO5	_	3	2	2	_	_	_	_	_	_	_	3
Average	_	2.6	2	2	_	_	_	_	_	_	_	3

OmDayal Group of Institutions
Department of Computer Science and Engineering

Subject Code: PEC-701E	Category: Computer Science and Engineering Course
Subject Name: MACHINE LEARNING	Semester: VII
L-T-P: 3-0-0	Credit:3

Module No	Description of Topic	Contact Hrs.
1	Unit 1: Supervised Learning (Regression/Classification) • Basic methods: Distance-based methods, Nearest-Neighbours, Decision • Trees, Naive Bayes • Linear models: Linear Regression, Logistic Regression, Generalized • Linear Models • Support Vector Machines, Nonlinearity and Kernel Methods • Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	10
2	Unit 2: Unsupervised Learning • Clustering: K-means/Kernel K-means • Dimensionality Reduction: PCA and kernel PCA • Matrix Factorization and Matrix Completion • Generative Models (mixture models and latent factor models)	7
3	Unit 3 Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6
4	Unit 4 Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representat i on Learning	9
5	Unit 5 Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Int roduct i on to Bay esian Learning and Inference	9
6	Unit 6: Recent trends in various learning techniques of machine learning and cl assificat i on meth ods	5

PROGRAMME OUTCOMES:

Engineering Graduates will be able to,

1. **PO1. Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **PO2. Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **PO3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **PO4. Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **PO5. Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **PO6. The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **PO7. Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **PO8. Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **PO9. Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **PO10. Communication**: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **PO11. Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **PO12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMMEE SPECIFIC OUTCOME (PSOs)

1. PSO1: To learn the concepts and methodologies of computer systems.
2. PSO2: To gain the knowledge of software development life cycles.
3. PSO3: To learn the concepts of recent developments in computer technologies.
1. PSO4: To apply the above knowledge in real life applications.

PREREQUISITE:

- Statistics, Linear Algebra, Calculus, Probability

OBJECTIVES:

- To learn the concept of how to learn patterns and concepts from data without being
- To design and analyse various machine learning algorithms and techniques with a modern
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

COURSE OUTCOME (COS)

After completing this course students will be able to,

PEC-CS701E.1	Recognize the characteristics of Machine Learning techniques that enable to solve real world problems.
PEC-CS701E.2	Recognize the characteristics of machine learning strategies
PEC-CS701E.3	Apply various supervised learning methods to appropriate problems
PEC-CS701E.4	Identify and integrate more than one techniques to enhance the performance of learning
PEC-CS701E.5	Create probabilistic and unsupervised learning models for handling unknown pattern

CO – PO MATRICES OF COURSES

	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PEC-CS701E.1	3	2	2	3	3	1	3	2	1	2	2	3
PEC-CS701E.2	3	3	2	3	3	2	3	2	1	2	3	3
PEC-CS701E.3	2	3	2	3	2	1	2	2	2	3	3	2

PEC-CS701E.4	2	2	2	3	3	3	3	3	2	2	3	3
PEC-CS701E.5	2	2	2	3	3	1	2	2	3	2	2	2
Average	2.4	2.4	2	3	2.8	1.6	2.6	2.2	1.8	2.5	2.6	2.6

Note:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put“-”

CO – PSOs MATRICES OF COURSES

CO	PSO1	PSO2	PSO3	PSO4
PEC-CS701E.1	3	2	2	3
PEC-CS701E.2	3	3	2	3
PEC-CS701E.3	3	2	3	3
PEC-CS701E.4	3	2	2	3
PEC-CS701E.5	3	3	2	3

Average	3	2.4	2.2	3

OmDayal Group of Institutions

Department ofComputer Science & Engineering

Subject Code: **PEC-CS 702E**	Category: **Professional Core courses**
Subject Name: **Cyber Security**	Semester: **VII**
L-T-P: **3-1-0**	Credit:**3**

Course Objectives:

To motivate the students to understand the basic facts about the cyber security and crime. Also to motivate them to know about the challenges and threats while implementing cyber security in practical.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction and Importance and challenges in Cyber Security, Getting idea about Cyberspace, Cyber threats, Cyberwarfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cybersecurity - Organizational Implications.	6
2	Introduction to Hackers and Cyber Crimes: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.	7
3	Ethical Hacking and Social Engineering: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modelling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defence Strategies.	8
4	Cyber Forensics and Auditing: Introduction to Cyber Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013	10
5	Cyber Ethics and Laws: Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act	5

	2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec.	

Course Outcomes:

1. Getting familiar with the basics of cyber security and its challenges and basic terms.
2. Knowing about the different types of attacks and challenges can be possible.
3. Having idea ethical hacking and social engineering in detail.
4. Get introduced to cyber forensic and auditing- get idea about the types of authentication, forensic fraud and challenges.
5. Also have some idea about cyber law and crimes, cyber cerificates.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1	To learn the concepts and methodologies of computer systems.
PSO 2	To gain the knowledge of software development life cycles.
PSO 3	To learn the concepts of recent developments in computer technologies.
PSO 4	To apply the above knowledge in real life applications.

CO	PO 1	PO2	P O 3	P O4	PO 5	P O 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PEC-CS 702E.1	3	2	-	2	2	-	1	2	2	3	3	3	2	-	3	4
PEC-CS 702E.2	3	3	2	-	2	-	-	3	3	3	3	3	3	-	4	4
PEC-CS 702E.3	3	3	3	-	2	-	2	3	3	3	3	2	2	-	3	3
PEC-CS 702E.4	3	3	3	-	-	-	1	2	2	3	1	2	1	-	4	3
PEC-CS 702E.5	2	2	2	-	1	-	1	1	3	3	2	2	3	-	3	3
AVERAGE	2.8	2.6	2	0.4	1.4	-	1	2.2	2.6	3	2.4	2.4	2.2	-	3.4	3.4

OmDayal Group of Institutions
Department of Computer Science andEngineering

Subject Code: OEC-CS701A	Category: Basic Science Course

Subject Name: Operations Research	Semester: VII
L-T-P: 2-1-0	Credit:3

Course Objectives:

To motivate or challenge students to understand the concepts of transportation problem , assignment problem ,CPM –PERT, formulation of Graphical problem and solve the problem of Queuing theory.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Basic LPP and Applications; Various Components of LP Problem Formulation.Solution of Linear Programming Problems:** Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems	17
2	**Network Analysis:**Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).Inventory Control:Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.	9
3	**Game Theory**: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance	5
4	**Queuing Theory**:Introduction; Basic Definitions andNotations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	5

Course Outcomes:

1. Set up decision models and use some solution methods for finding solutions of problems. and to formulate and apply LPP and solution of LPP by Graphical Method and Simplex Method.
2. Methods of solving Transportation Problems and Assignment Problems.
3. To develop the network and to find the shortest path, critical path using PERT and CPM method, maximal flow of Network analysis by Floyd's Algorithm and Fulkerson's Algorithm
4. To develop the modeling and mathematical skills to analytically determine queuing models and finding various parameters associated with the model and applications of some real life situations.
5. Introduction to 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems and solving its problem.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OEC-CS701A.CO1	-	2	3	3	_	_	_	_	_	_	3	3

OEC-CS701A.CO2	_	3	3	2	_	_	_	_	_	_	3	3
OEC-CS701A.CO3	_	3	3	3	_	_	_	_	_	_	3	3
OEC-CS701A.CO4	_	3	2	3	_	_	_	_	_	_	3	3
OEC-CS701A.CO5	_	2	2	3	_	_	_	_	_	_	3	3
Average	-	2.6	2.6	2.8	_	_	_	_	_	_	3	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Financial

PO12: Life-Long Learning

<u>OmDayal Group of Institutions</u>

Department of Electrical Engineering

Subject Code: **OE-EE-701A**	Category: **Elective optional**
Subject Name: **Artificial intelligence**	Semester: **V**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. To provide a strong foundation of fundamental concepts in Artificial Intelligence
2. To provide a basic exposition to the goals and methods of Artificial Intelligence
3. To enable the student to apply these techniques in applications which involve perception, reasoning and learning.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction: Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents: Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving : Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	6
2	Search techniques: Solving problems by searching : problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies: Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. Adversarial search: Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening	13
3	Knowledge & reasoning : Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	6
4	Using predicate logic: Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural-deduction. Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	6
5	Natural Language processing : Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. Learning: Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. Expert Systems : Representing and using domain knowledge, expert system shells, knowledge acquisition.	9

Course Outcomes:

1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.

2. Apply these techniques in applications which involve perception, reasoning and learning. 3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.

4. Acquire the knowledge of real world Knowledge representation.

5. Analyze and design a real world problem for implementation and understand the dynamic behaviour of a system and use different machine learning techniques to design AI machine and enveloping applications for real world problems.

Course Name: OE-EE-701A (Artificial intelligence)

CO/PO -PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
OE-EE-701A.1	1	1	2	3	2	1	2	1	2	1	1	2	1	2	2	1
OE-EE-701A.2	2	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
OE-EE-701A.3	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1
OE-EE-701A.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
OE-EE-701A.5	3	2	2	2	2	1	1	0	1	2	2	1	1	2	2	2
Average	1.6	1.5	1.8	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

OmDayal Group of Institutions

Department of Basic Science and Humanities

Subject Code: **HSMC701**	Category: Humanities &Social Science
Subject Name: Project Management and Entrepreneurship	Semester: **VII**
L-T-P: **2-1-0**	Credit:**3**

Course Objectives:

1 Discuss the types of entrepreneurship and the factors effecting entrepreneur
2. Discuss about competencies and motivation required to become an entrepreneur.
3 Extend the business concepts towards a start – up considering all factors
4 Explain the financial and accounting details needed for starting and running a small enterprise
5. Explain accurately the processes and interactions a practitioner undertakes to achieve project goals. Analyze the iterative processes of a project correctly.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	ENTREPRENEURSHIP 1. Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks [2L] 2. Entrepreneurship – An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur [2L] 3. Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand-supply analysis [4L] 4. Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies [2L] 5. Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures – bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation – SISI, KVIC, DGFT, SIDBI, Defense and Railways [4L] 6. Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L] 7. Applications and Project Reports Preparation [4L]	2 2 4 2 4 2 4
2	PROJECT MANAGEMENT : 8.Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization	

	Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L] 9. Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L] 10. Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L] 11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L] 12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L] 13. Case Studies with Hands-on Training on MS-Project [4L]	4 2 2 6 2 4

Course Outcomes:

On completion of the course students will be able to

1. Entrepreneurship and Innovation minors will be able to sell themselves and their ideas.
2. Entrepreneurship and Innovation minors will be able to find problems worth solving.
3. Entrepreneurship and Innovation minors will be able to mobilize people and resources.
4. Explain accurately the processes and interactions a practitioner undertakes to achieve project goals. Analyze the iterative processes of a project correctly.
5. Identify and effectively communicate best practices within the framework of projects.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HSMC701.CO1	-	-	-	2	-	-	-	2	-	2	-	2
HSMC701.CO2	-	2	-	2	-	-	-	2	-	2	-	2

HSMC701.CO3	-	1	2	-	-	-	-	-	-	2	-	-
HSMC701.CO4	-	2	-	2	-	-	-	-	-	2	3	3
HSMC701.CO5	-	2	2	-	-	-	-	-	-	2	2	3
Average	-	1.4	.8	1.2	-	-	-	.8	-	2	1	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

<u>OmDayal Group of Institutions</u>

Department of Computer Sc Engineering

Subject Code: **PCC-CS801D**	Category: **Professional Core courses**
Subject Name: Web & Internet Technology	Semester: **VII**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. Having Idea About Internet, Intranet andExtranet
2. Getting Idea About Different Types of Protocol for Internet Technology
3. Understanding Classfull and Classless IPAddressing
4. Understanding Security Issues, Threads andAttacks
5. Understanding Implementations in HTML, JSP andPERL

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Overview,NetworkofNetworks,Intranet,Extranet andInternet.Domain and Sub domain, Address Resolution, DNS,Telnet,FTP,HTTP.Features, Segment, Three-Way Handshaking, FlowControl, Error Control, Congestion control, IPDatagram,IPv4andIPv6.Classful and Classless Addressing, Subnetting. NAT,IPmasquerading,IP tables.Routing -Intra and Inter Domain Routing, Unicast andMulticastRouting, Broadcast.POP3, SMTP.	6
2	Introduction, Editors, Elements, Attributes, Heading,Paragraph. Formatting, Link, Head, Table, List, Block,Layout, CSS. Form, Iframe, Colors, Colorname,Colorvalue. map, area, attributes of image area. Introduction, Tree, Syntax, Elements, Attributes,Validation, Viewing. XHTMLin brief.Introduction,EnvironmentVariable,GETandPOSTMethods.	9
3	Introduction, Variable, Condition, Loop, Array,Implementing data structure, Hash, String, RegularExpression, Filehandling,I/Ohandling Basics, Statements, comments, variable, comparison,condition, switch, loop, break. Object – string, array,Boolean,reg-ex.Function, Errors,Validation. Definition of cookies, Create and Store a cookie withexample. ContainerClass,Components,AppletLifeCycle,Updatemethod;Para meterpassingapplet,Applications..	10
4	Malicious code-viruses, Trojan horses, worms;eavesdropping,spoofing,modification,denialofserviceattacks. Password andAuthentication; VPN, IP Security, security inelectronictransaction,SecureSocket Layer(SSL),SecureShell(SSH). Introduction,Packetfiltering,Stateful,Applicationlayer,Proxy.	4
5	Introduction, VoIP.MultimediaMultimedia over IP: RSVP, RTP, RTCP and RTSP.Streamingmedia, Codec andPlugins,IPTV. SearchDefinition,Metadata,WebCrawler, Indexing,Pagerank,overviewof SEO..	5

Course Outcomes:

1. Understanding & recognizing current trend of web development and computer network..

2. Getting Idea About Different Types of Protocol and layers for Internet Technology
3. Getting idea of IP addressing.
4. Getting idea of web development
5. Understanding Implementations in HTML, JSP andPERL
6. **PROGRAM SPECIFIC OUTCOMES (PSO)**

PSO 1	To learn the concepts and methodologies of computer systems.
PSO 2	To gain the knowledge of software development life cycles.
PSO 3	To learn the concepts of recent developments in computer technologies.
PSO 4	To apply the above knowledge in real life applications.

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO 10	PO1 1	PO1 2	PS O 1	PS O 2	PS O 3	PSO 4
PCC-CS801 D .1	3	1	-	-	1	1	-	-	3	3	3	2	2	-	4	3
PCC-CS801 D.2	3	2	-	1	-	-	3	2	1	3	3	3	3	-	3	3
PCC-CS801 D.3	3	1	1	-	1	1	3	2	3	3	3	2	3	-	2	3
PCC-CS801 D.4	3	3	2	-	3	2	3	2	3	3	3	3	4	-	3	3
PCC-CS801 D.5	3	3	2	-	3	2	3	2	3	3	3	3	2	-	3	3
AVERAGE	3	2	1	0.2	1.6	1.2	2.4	1.6	2.6	3	3	2.6	2.8	-	3	3

OmDayal Group of Institutions
Department of Computer Sc Engineering

Subject Code: **OEC-CS801B**	Category: **Professional Core courses**
Subject Name: Cyber Law &ethics	Semester: **VII**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2. Students locate and apply case law and common law to current legal dilemmas in the technology field.
3. Students apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4. Students distinguish enforceable contracts from non-enforceable contracts.
5. Students demonstrate leadership and teamwork

Course Content:

Module No	Description of Topic	Contact Hrs.
1	What is cybercrime?,Forgery,Hacking,SoftwarePiracy,ComputerNetworkintrusion .How criminals plan attacks,passiveattack,Activeattacks,cyberstalking.	8
2	Securitychallengespostedbymobiledevices,cryptographicsecurityformobiledevices ,Attackson mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Differentviruses on laptop.	8
3	Proxyservers, panword checking, Random checking, Trojan Horses and Backdoors; DOS&DDOSattacks; SQL injection: bufferover flow.	8
4	Phising methods, IDTheft; Onlineidentitymethod. Legal aspects, indianlaws,IT act, Publickeycertificate.	8

Course Outcomes:

1. Understanding & recognizing current trend of web Cyber world.

2. Getting idea of the ethical & unethical hacking and laws.

3. Getting idea about internet crime and precautions.

4. Getting idea about malwares and how to protect from them

5. Getting idea for secure communication.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1	To learn the concepts and methodologies of computer systems.
PSO 2	To gain the knowledge of software development life cycles.
PSO 3	To learn the concepts of recent developments in computer technologies.
PSO 4	To apply the above knowledge in real life applications.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO 3	PSO 4
OEC-CS801B.1	3	2	-	2	2	-	1	2	2	3	3	3	2	-	3	4
OEC-CS801B.2	3	3	2	-	2	-	-	3	3	3	3	3	3	-	4	4
OEC-CS801B.3	3	3	3	-	2	-	2	3	3	3	3	2	2	-	3	3
OEC-CS801B.4	3	3	3	-	-	-	1	2	2	3	1	2	1	-	4	3
OEC-CS801B.5	2	2	2	-	1	-	1	1	3	3	2	2	3	-	3	3
AVERAGE	2.8	2.6	2	0.4	1.4	-	1	2.2	2.6	3	2.4	2.4	2.2	-	3.4	3.4

OmDayal Group of Institutions
Department of Computer Science and Engineering

Subject Code: OEC-CS802A	Category: Computer Science Course
Subject Name: E-Commerce & ERP	Semester: IV
L-T-P: 3-0-0	Credit:4

Module No	Description of Topic	Contact Hrs.
1	Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws	**3 L**
2	Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce	**5 L**
3	Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance	**2 L**
4	E – strategy : Overview, Strategic Methods for developing E – commerce	**2 L**
5	Four C's : (Convergence, Collaborative Computing, Content Management & Call Center). Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content –partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment, Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE).	**6 L**
6	Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power	**3 L**
7	E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections	**1 L**
8	E – Marketing :. Home –shopping, E-Marketing, Tele-marketing	**1 L**
9	Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA).	**2 L**
10	Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.	**4 L**
11	Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, Quality	**10 L**

	Management, Sales & Distribution ERP Package, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP	

PROGRAMME OUTCOMES:

Engineering Graduates will be able to,

1. **PO1. Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **PO2. Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **PO3. Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **PO4. Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **PO5. Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **PO6. The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **PO7. Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **PO8. Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **PO9. Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **PO10. Communication**: Communicate effectively on complex engineering activities with the Engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive
    clear instructions.

11. **PO11. Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **PO12. Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMMEE SPECIFIC OUTCOME (PSOs)

1. PSO1: To learn the concepts and methodologies of computer systems.
2. PSO2: To gain the knowledge of software development life cycles.
3. PSO3: To learn the concepts of recent developments in computer technologies.
4. PSO4: To apply the above knowledge in real life applications.

OBJECTIVES:

- Describe e-commerce framework
- Explain electronic system for payment
- Describe the use of e-commerce advertising and marketing
- Understand business documents and digital library.
- Understand the usage of multimedia systems for e-commerce.

COURSE OUTCOME (COS)

After completing this course students will be able to,

OEC-CS802A.1	Understand the basic concepts and technologies used in the field of management information systems
OEC-CS802A.2	Have the knowledge of the different types of management information systems and understand the processes of developing and implementing information systems
OEC-CS802A.3	Be aware of the ethical, social, and security issues of information systems
OEC-CS802A.4	Analyze the impact of E-commerce on business models and strategy
OEC-CS802A.5	Explain the process that should be followed in building an E-commerce presence

CO – PO MATRICES OF COURSES

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
OEC-CS802A.1	3	2	3	3	3	2	3	1	1	2	3	2

OEC-CS802A.2	3	3	3	3	3	2	3	3	3	2	2	2
OEC-CS802A.3	3	3	3	3	3	2	2	3	1	2	3	2
OEC-CS802A.4	3	3	3	3	3	3	2	3	2	2	3	3
OEC-CS802A.5	3	3	3	3	3	3	3	3	1	2	3	3
Average	3	3	3	3	3	2.4	2.8	2.6	1.6	2	2.8	2.4

Note:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO – PSOs MATRICES OF COURSES

CO	PSO1	PSO2	PSO3	PSO4
OEC-CS802A.1	3	2	2	3
OEC-CS802A.2	3	3	2	3
OEC-CS802A.3	3	2	3	3
OEC-CS802A.4	3	2	2	3
Average	3	1.8	1.8	3

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **BS-PH101**	Category: **Basic Science Courses**
Subject Name: **Physics-I**	Semester: **I**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

To motivate or challenge students to understand basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Mechanics:** Problems including constraints & friction. Basic ideas of vector calculus and partial Differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a planeand in 3D. Angular velocity vector. Moment of inertia.	7
2	**Optics:** Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating (resolution formulae only), characteristics of diffraction grating and its applications. Polarisation: Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity. Lasers: Principles and working of laser: population inversion, pumping, various modes, threshold population inversion with examples.	5
3	**Electromagnetism and Dielectric Magnetic Properties of Materials:** Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation (expression only), applications of dielectrics. Magnetisation permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.	8
4	**Quantum Mechanics:** Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.	16
5	**Statistical Mechanics:** Macro-state, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.	8

Course Outcomes:

CO1:	Upon completion of this course, students will be able to understand the Basic concepts of mechanics, effect of various types of forces on a body, causes and effects of vibration.
CO2:	Students will be able to interpret the intensity variation of light due to Polarization, interference and diffraction, transverse nature of Light-Polarization, Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
CO3:	Upon completion of this course, students will be able to understand the magnetic and dielectric properties of various material and also properties of materials such as, permeability, polarization, etc.
CO4:	Students will be familiar with some of the basic laws related to quantum mechanics as well as simple quantum mechanics calculations.
CO5:	Upon completion of this course, students will be able to understand the application of statistical Mechanics in case of Engineering Thermodynamics.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	3	3	-	-	-	-	-	3
CO2	3	3	3	3	3	2	-	-	-	-	-	3
CO3	3	3	3	3	3	3	-	-	-	-	-	3
CO4	3	3	3	3	3	3	-	-	-	-	-	3
CO5	3	3	3	3	2	2	-	-	-	-	-	3
Avg	3	3	3	3	2.8	2.6	-	-	-	-	-	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **BS-M102**	Category: **Basic Science Course**
Subject Name: **Mathematics – IB**	Semester: **I**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

To motivate or challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Calculus (Integration):** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	**Calculus (Differentiation):** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	**Sequence and Series:** Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem	11
4	**Multivariate Calculus:** Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	**Matrices:** Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course, the student will be able to

CO1: Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

CO2: Understand the domain of applications of mean value theorems to engineering problems.

CO3: Learn the tools of power series and Fourier series to analyse engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines

CO4: Apply the knowledge for addressing the real-life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

CO5: Understand the different types of matrices, concept of rank, methods of matrix inversion and their applications.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	2	3	3	3	-	-	-	-	-	-	-	3
CO2	3	3	1	2	-	-	-	-	-	-	-	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3
CO4	3	3	2	3	-	1	-	-	-	-	-	3
CO5	2	3	2	2	-	-	-	-	-	-	-	3
Avg	2.6	3	2.2	2.6	-	1	-	-	-	-	-	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Course Code: **ES-EE101**	Category: **Engineering Science Courses**
Course Title: **Basic Electrical Engineering**	Semester: **I**
L-T-P : **3-1-0**	Credit: **4**

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	8
2	**AC Circuits** Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	8
3	**Transformers** Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections	6
4	**Electrical Machines** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.	8
5	**Power Converters** DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.	6
6	**Electrical Installations** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	6

Course Outcomes:

CO1: To understand and analyze DC circuits and relevant theorems.
CO2: To understand different AC network theorems, circuits and tools for solution of networks.
CO3: To study the working principles of power converters.
CO4: To introduce the components of low voltage electrical installations.
CO5: To understand basic concepts, construction, working principle and fundamentals of Electric Machines.

Program Outcomes:

<u>Engineering Graduates will be able to:</u>

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	2	3	3	1	-	-	-	-	3	3	3	3
CO2	3	3	3	2	3	3	1	-	-	-	-	3	2	1	2
CO3	3	3	3	2	3	3	2	-	-	-	-	3	2	1	2
CO4	3	3	3	1	3	3	2	-	-	-	-	3	2	1	2
CO5	3	3	3	1	3	3	2	-	-	-	-	3	2	1	2
Avg	3	3	3	1.6	3	3	1.6	-	-	-	-	3	2.2	1.4	2.2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **BS-PH191**	Category: **Basic Science Courses**
Subject Name: **Physics-I Laboratory**	Semester: **I**
L-T-P: **0-0-3**	Credit:**1.5**

Course Content:

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics
1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments
1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics
1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments
1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and sheer force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

Course Outcomes:

CO1: Analyses the physical properties of Light as well as the phenomenon of Dispersion to perceive concepts of modern optics.

CO2: Determine electrical and magnetic properties.

CO3: Measure some quantum mechanical constants.

CO4: Analyses the different parameter related to general properties of matter.

CO5: Determine the elastics and viscous properties.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	2	1	-	-	3	-	-	3
CO2	3	3	3	3	3	1	-	-	3	-	-	3
CO3	3	2	3	3	3	1	-	-	3	-	-	3
CO4	3	3	3	3	2	-	-	-	3	-	-	3
CO5	3	3	3	3	2	1	-	-	3	-	-	3
Avg	3	2.8	3	3	2.4	1	-	-	3	-	-	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **ES-EE 291**	Category: **Basic Engineering Courses**
Subject Name: **Basic Electrical Engineering Laboratory**	Semester: **I**
L-T-P: **0-0-2**	Credit:**1**

Course Content:

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments:
   a) Voltmeter
   b) Ammeter
   c) Multimeter
   d) Oscilloscope
3. Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.
4. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronousmachine and single-phase induction machine.
5. Calibration of ammeter and Wattmeter.
6. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
7. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation ofimpedance and power factor.
8. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
   (a) Open circuit and short circuit test of a single-phase transformer
   (b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three-phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change ofphase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

Course Outcomes:

CO1: To understand basic safety precautions and instructions.

CO2: To understand the concept of calibration of ammeter and wattmeter, basics of active power and reactive power, balanced, unbalanced system and power measurement.

CO3: To understand steady state and transient response of R-L, R-C and R-L-C circuit, resonance frequency and quality factor.

CO4: To study open circuit and short circuit test of a single-phase transformer

CO5: To study the torque-speed characteristics of separately excited dc motor, induction motor and operating characteristics of synchronous generator.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and

engineering sciences.

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PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	2	3	3	3	2	3	3	-	3	3	3	3
CO2	3	3	2	2	3	3	2	-	-	-	-	3	2	1	2
CO3	3	3	3	2	3	3	2	-	-	-	-	3	2	1	2
CO4	3	3	3	1	3	3	-	-	-	-	-	3	2	1	2
CO5	3	3	3	1	3	3	-	-	-	-	-	3	2	1	2
Avg	3	3	3	1.6	3	3	2.3	2	3	3	-	3	2.2	1.4	2.2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Course Code: **ES-ME 192**	Category: **Engineering Science Courses**
Course Title: **Workshop/ Manufacturing Practices**	Semester: **I**
L-T-P: **1-0-4**	Credit:**3**
Course Content:	

(i) Lectures & videos:

Detailed contents:
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)
Typical jobs that may be made in this practice module:
To make a pin from a mild steel rod in a lathe.
To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)
Typical jobs that may be made in this practice module:
To make a Gauge from MS plate.

Carpentry (8 hours)
Typical jobs that may be made in this practice module:
To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))
Typical jobs that may be made in this practice module:
ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.
GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)
Typical jobs that may be made in this practice module:
One/ two green sand moulds to prepare, and a casting be demonstrated.

Smithy (4 hours) ~ 4 hours
Typical jobs that may be made in this practice module:
A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)
Typical jobs that may be made in this practice module:
For plastic moulding, making at least one simple plastic component should be made.
For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)
Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable. Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.
Simple wiring exercise to be executed to understand the basic electrical circuit. Simple soldering exercises to be executed to understand the basic process of soldering. Fabrication of a single-phase full wave rectifier with a step-down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Course Outcomes:

CO1: Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

CO2: They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

CO3: By assembling different components, they will be able to produce small devices of their interest.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	1	-	1	-	-	-	-	-	3	1	-	3	1	2	-
CO2	1	-	1	-	1	-	-	-	3	-	-	3	1	2	1
CO3	1	-	1	-	1	-	-	-	3	1	-	3	1	2	-
Avg	1	-	1	-	1	-	-	-	3	1	-	3	1	2	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Course Code: **BS-CH201**	Category: **Basic Science Courses**
Course Title: **Chemistry-I**	**Se**mester: **II**
L-T-P : **3-1-0**	Credit:**4**

Course Objectives:

To motivate students to understand the basic concepts of atomic and molecular structure, spectroscopic techniques and applications, free energy and equilibrium, periodic properties of elements and stereochemistry and structures of compounds and study the different types of organic reactions

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Atomic and molecular structure:** Schrodinger equation. Particle in box solutions and their applications for simple sample. Molecular orbitalsof diatomic molecules (e.g.H_2). Energy level diagrams of diatomic. Pi-molecular orbital of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solidsand the role of doping on band structures.	10
2	**Spectroscopic techniques and applications** Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering	8
3	**Intermolecular forces and potential energy surfaces** Ionic, dipolar and van Der Waals interactions. Equations of state of realgases and critical phenomena	4
4	**Use of free energy in chemical equilibria** First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.	8
5	**Periodic properties** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries	4
6	**Stereochemistry** Representations of 3dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers,diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds	4
7	**Organic reactions and synthesis of a drug molecule** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.	4

Course Outcomes:

CO1: Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecularforces.

CO2: Rationalize bulk properties and processes using thermodynamic considerations.

CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecularenergy levels in various spectroscopic techniques

CO4: Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.

CO5: List major chemical reactions that are used in the synthesis of molecules.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	2	2	-	-	-	-	2	-	-	-	-	2
CO2	2	2	2	-	-	-	2	-	-	-	-	2
CO3	2	2	2	-	2	-	2	-	-	-	-	2
CO4	2	2	-	-	-	-	2	-	-	-	-	2
CO5	2	2	2	-	2	-	-	-	-	-	-	2
Avg	2	2	2	-	2	-	2	-	-	-	-	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **BS-M202**	Category: **Basic Science Course**
Subject Name: **Mathematics – IIB**	Semester: **II**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:
To motivate students to understand the basic concepts of Multivariate calculus integration,1st order and 2nd order differential equation and study the complex variables with their differentiation and integration.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Multivariate Calculus (Integration):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	**First order ordinary differential equations:** Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	**Ordinary differential equations of higher orders:** Second order linear differential equations with constant coefficients, Use of D- operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	**Complex Variable – Differentiation**: Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties	6
5	Complex Variable – Integration Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville'stheorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour	9

Course Outcomes:

CO1: Learn the methods for evaluating multiple integrals and their applications to different physical problems.

CO2: Understand different techniques to solve first and second order ordinary differentialequations with its formulation to address the modelling of systems and problems of engineering sciences.

CO3: Learn different tools of differentiation and integration of functions of a complex variablethat are used with various other techniques for solving engineering problems.

CO4: Apply different types of transformations between two 2- dimensional planes for analysis ofphysical or engineering problems.

CO5: Understand different techniques to solve Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions and used with various other techniques for solving engineering problems.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	2	3	2	2	-	-	-	-	-	-	-	3
CO2	2	3	3	2	-	-	-	-	-	-	-	3
CO3	2	3	2	2	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2
CO5	2	3	-	2	-	-	-	-	-	-	-	2
Avg	2	3	2.25	2	-	-	-	-	-	-	-	2.4

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **ES-CS201**	Category: **Engineering Science Courses**
Subject Name: **Programming for Problem Solving**	Semester: **II**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future. The course aims to provide exposure to problem-solving through programming. It aims to train the student to the basic concepts of the C-programming language. This course involves a lab component which is designed to give the student hands-on experience with the concept.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) . Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code	4
2	Arithmetic expressions and precedence	2
3	Conditional Branching and Loops. Writing and evaluation of conditionals and consequent branching. Iteration and loops	6
4	Arrays (1-D, 2-D), Character arrays and Strings	6
5	Basic Algorithms. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)	6
6	Functions (including using built in libraries), Parameter passing infunctions, call by value, Passing arrays to functions: idea of call by reference	5
7	Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.Quick sort or Merge sort.	5
8	Structures, Defining structures and Array of Structures	4
9	Idea of pointers, Defining pointers, Use of Pointers in self-referentialstructures, notion of linked list (no implementation)	2
10	File handling.	2

Course Outcomes:

CO1: To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).

CO2: To test and execute the programs and correct syntax and logical errors. To implement conditional branching, iteration and recursion

CO3: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

CO4: To use arrays, pointers and structures to formulate algorithms and programs.

CO5: To apply programming to solve matrix addition and multiplication problems and searching and sorting problem. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping															
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	3	1	1	1	1	2	3	-	2	3	1	2	2	1
CO2	3	1	2	1	2	1	-	-	3	2	2	2	3	2	3
CO3	2	3	2	2	2	-	2	3	3	2	3	2	2	-	3
CO4	2	3	3	2	-	2	1	2	2	3	1	-	2	3	2
CO5	3	3	2	2	2	2	1	-	3	3	2	3	3	3	2
Avg	2.4	2.6	2	1.6	1.4	1.2	1.2	1.6	2.2	2.4	2.2	1.6	2.4	2.0	2.2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Course Code: **HM HU 201**	Category: **Humanities and Social Sciences including Management courses**
Course Title: **English**	Semester: **II**
L-T-P : **2-0-0**	Credit**: 2**

Course Objectives:

To help students develop basic proficiency in English Grammar, Vocabulary and Composition, and writing skills.

To help students identify common errors in writing and gain editing skills in the process.

To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs and emails.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	1. Vocabulary Building 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending. 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms	8
2	2. Basic Writing Skills 2.1 Sentence Structures & Types: Simple, Compound, Complex 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration 2.3 Importance of proper punctuation 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order 2.5 Creating Cohesion: Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely	10
3	**3.** Identifying Common Errors in Writing 3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés	8
4	4. Nature and Style of sensible Writing 4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion	10
5	5. Writing Practices 5.1 Comprehension 5.2 Précis Writing 5.3 Essay Writing 5.4 Business Letter, Cover Letter & CV; E-mail	8

Course Outcomes:

CO1: The student will acquire basic proficiency in English including reading and listening comprehension.
CO2: The student will acquire basic proficiency in English grammar and vocabulary.
CO3: The student will acquire basic proficiency in writing basic technical documents such as business letters, cover letters, CV and emails.
CO4: The student will acquire basic proficiency in understanding the nature and style of proper writing.
CO5: The student will learn to identify and edit common writing errors.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	-	2	-	2	-	1	-	2	1	3	1	3
CO2	-	-	1	1	-	1	-	2	-	3	-	3
CO3	-	2	2	2	-	2	1	3	3	3	2	3
CO4	-	2	1	-	-	-	1	3	2	3	-	3
CO5	-	1	1	1	-	1	1	3	1	3	1	3
Avg	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **BS-CH 291**	Category: **Basic Science Courses**
Subject Name: **Chemistry-I Laboratory**	Semester: **I**
L-T-P: **0-0-3**	Credit:**1.5**

Course Objectives:

To motivate students to understand the basic concepts of conductance, pH, electrochemical cells and its applications, measure Chloride ion and Dissolved Oxygen in given water sample, separation of mixtures, and study viscosity and partition coefficient.

Course Content:

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part

Course Outcomes:

CO1: Estimate the concentration of acid/alkali, cell constant by conductometric/ pH metric method using electrochemical cells.

CO2: Analyze different components from their mixtures by adsorption and TLC method.

CO3: Calculate the composition of given solution using Oswald Viscometer.

CO4: Determine rate constant for hydrolysis of ester by acid catalyzed and distribution coefficient of acetic acid between n-butanol and water

CO5: Determine the amount of chloride and dissolved oxygen present in a given water sample

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

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CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	2	2	2	-	2	2	2	-	-	-	-	2
CO2	2	2	2	-	2	2	-	-	-	-	-	2
CO3	-	-	2	-	-	2	-	-	-	-	-	2
CO4	-	-	2	-	-	2	-	-	-	-	-	2
CO5	-	2	2	-	-	2	2	-	-	-	-	2
Avg	2	2	2		2	2	2	-	-	-	-	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **ES-CS 291**	Category: **Engineering Science Courses**
Subject Name: **Programming for Problem Solving Laboratory**	Semester: **II**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

Learn preprogramming steps like writing algorithms, drawing flowcharts. Understand the structure and learn the syntax and semantics of C programming. variable declaration with different data types and using operators. Concept of different control structures like decision control, loop control and special the concepts and advantages of using functions.¬ Understand the limitations of basic data types and concepts of derived. data types and user defined data types. Learn how to perform various FILE I/O.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction to Programming**: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) . Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory	4
2	Arithmetic expressions and precedence.	2
3	**Conditional Branching and Loops**: Writing and evaluation of conditionals and consequent branching . Iteration and loops	6
4	Arrays : Arrays (1-D, 2-D), Character arrays and Strings	6
5	Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)	6
6	Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference	5
7	Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	5
8	Structure :Structures, Defining structures and Array of Structures	4
9	Pointers : Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list(no implementation)	2
10	File handling	2

Course Outcomes:

CO1: To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).

CO2: To test and execute the programs and correct syntax and logical errors. To implement conditional branching, iteration and recursion.

CO3: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

CO4: To use arrays, pointers and structures to formulate algorithms and programs. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

CO5: To apply programming to solve simple numerical method problems, namely rot finding of function, Differentiation of function and simple integration

Program Outcomes:

<u>Engineering Graduates will be able to:</u>

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	3	1	1	1	1	2	3	-	2	3	1	2	2	1
CO2	3	1	2	1	2	1	-	-	3	2	2	2	3	2	3
CO3	1	3	1	2	2	-	2	3	3	2	3	2	2	-	3
CO4	2	3	3	2	-	2	1	2	2	3	1	-	2	3	2
CO5	3	3	2	2	2	2	1	-	3	3	2	3	3	3	2
Avg	2.2	2.6	1.8	1.6	1.4	1.2	1.2	1.6	2.2	2.4	2.2	1.6	2.4	2.0	2.2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **ES-ME 291**	Category: **Engineering Science Courses**
Subject Name: **Engineering Graphics & Design**	Semester: **II**
L-T-P: **1-0-4**	Credit:**3**

Course Objectives:

Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	INTRODUCTION TO ENGINEERING DRAWING Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	5
2	**LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales.	5
3	**GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedean Spiral.	5
4	**PROJECTION OF POINTS, LINES, SURFACES** Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	5
5	**PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	5
6	**COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	5
7	**ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	5
8	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	5
9	**OVERVIEW OF COMPUTER GRAPHICS**, C**USTOMISATION & CAD DRAWING** Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically;	5

	Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	
10	**ANNOTATIONS, LAYERING & OTHER FUNCTIONS** Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	10
11	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	10

Course Outcomes:

CO1: Introduction to engineering design and its place in society
CO2: Exposure to the visual aspects of engineering design
CO3: Exposure to engineering graphics standards
CO4: Exposure to solid modeling
CO5: Introduction to AutoCAD

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional

engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	1	-	-	-	-	1	-	-	-	1	-	2	-	-	-
CO2	3	2	2	1	-	-	-	-	2	1	-	-	3	3	3
CO3	3	2	2	-	-	-	-	-	-	1	-	2	3	3	3
CO4	3	2	2	-	-	-	-	-	2	1	-	2	3	3	3
CO5	3	2	2	-	3	-	-	-	2	1	-	2	3	3	3
Avg	2.6	2	2	1	3	1	-	-	2	1	-	2	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **HM-HU 291**	Category: **Humanities and Social Sciences including Management courses**
Subject Name: **Language Laboratory**	Semester: **II**
L-T-P: **0-0-2**	Credit:**1**

Course Objectives:

To help students develop basic proficiency in English Grammar, Vocabulary and Composition, and writing skills.
To help students identify common errors in writing and gain editing skills in the process.
To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs and emails in a practical setup.
To help students develop their conversation skills, linguistic skills and paralinguistic skills.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Honing 'Listening Skill' and its sub skills through Language Lab Audio device	3
2	Honing 'Speaking Skill' and its sub skills	2
3	Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech	2
4	Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode)	2
5	Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success	2
6	G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD	4
7	Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non-Technical Passages Learning Global / Contextual / Inferential Comprehension	2

Course Outcomes:

After completing this course, the students will be able to

CO1: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.
CO2: The student will be able to type effectively for recording technical documents.
CO3: The student will be able to develop appropriate body language and pronunciation.
CO4: The student will be able to effectively participate in debates and group discussions.
CO5: The student will be able to use computers and related software efficiently.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods

including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	-	2	-	2	-	1	-	2	1	3	1	3
CO2	-	-	1	1	-	1	-	2	-	3	-	3
CO3	-	2	2	2	-	2	1	3	3	3	2	3
CO4	-	2	1	-	-	-	1	3	2	3	-	3
CO5	-	1	1	1	-	1	1	3	1	3	1	3
Avg	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **BS-M301**	Category: **Basic Science Course**
Subject Name: **Mathematics – III**	Semester: **III**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

To motivate or challenge students to understand the concept of probability theory and their different types probability distribution functions and studies the different types of hypotheses and solve the different types of partial differential equations.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variable.	14
2	Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.	12
3	Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal -evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and moregeneral curves. Test of significance: Large sample test for single proportion,difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	12

Course Outcomes:

CO1: Students will be able to solve field problems in Engineering involving PDEs.

CO2: Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

CO3: Understand the basic ideas of statistics with different characterization of a univariate and bivariate data set.

CO4: Apply statistical tools for analyzing data samples and drawing inference on a given dataset.

CO5: Students can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	2	3	3	3	-	-	-	-	-	-	-	3
CO2	-	2	3	1	-	-	-	-	-	-	-	3
CO3	-	2	3	3	-	-	-	-	-	-	-	3
CO4	-	3	2	3	-	-	-	-	-	-	-	3
CO5	-	3	2	3	-	-	-	-	-	-	-	3
Avg	2	2.6	2.6	2.6	-	-	-	-	-	-	-	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Course Code: **BS-BIO301**	Category: **Basic Science Courses**
Course Title: **Biology**	Semester: **III**
L-T-P : **3-0-0**	Credit:**3**

Course Objectives:

To introduce modern biology with an emphasis on evolution of biology as a multi-disciplinary field and to make students aware of application of engineering principles in biology and engineering robust solution inspired by biological examples.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction** Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will high light the fundamental importance of observations in any scientific inquiry	2
2	**Classification:** Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or Multicellular (b) ultrastructure prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus.	3
3	**Genetics:** Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessive ness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4
4	**Biomolecules** Purpose: To convey that all forms of life has the same building blocks andyet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	4
5	**Enzymes** Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	4
6	**Information Transfer** Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of	4

	genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	
7	**Macromolecular analysis:** Purpose: To analyze biological processes at the reductionistic level. Proteins-structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5
8	**Metabolism** Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4
9	**Microbiology** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3

Course Outcomes:

CO1: Describe how biological observations of 18th Century that lead to major discoveries.

CO2: Convey that classification per se is not what biology is all about but highlight the underlyingcriteria, such as morphological, biochemical and ecological

CO3: Highlight the concepts of recessive Ness and dominance during the passage of genetic material from parent to offspring and identify DNA as a genetic material in the molecular basis of information transfer.

CO4: Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine and analyse biological processes at the reductionistic level

CO5: Classify enzymes and distinguish between different mechanisms of enzyme action.

Program Outcomes:

<u>Engineering Graduates will be able to:</u>

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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engineering practice

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PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	2	-	-	-	2	2	-	-	-	-	-	3
CO2	1	2	-	-	1	2	3	-	-	-	-	3
CO3	1	3	2	-	2	2	3	-	-	-	-	3
CO4	-	2	-	-	1	1	2	-	-	-	-	3
CO5	2	2	1	-	-	2	2	-	-	-	-	3
Avg	1.5	2.25	1.5	-	1.5	1.8	2.5	-	-	-	-	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **ES-ECE301**	Category: **Engineering Science Courses**
Subject Name: **Basic Electronics Engineering**	Semester: **III**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To provide an overview of electronic device components to Mechanical engineering students

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Semiconductor Devices and Applications: Introduction to P-N junctionDiode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.	7
2	Semiconductor Devices and Applications: Introduction to P-N junctionDiode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency responseand bandwidth.	6
3	Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as table and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.	6
4	Digital Electronics Fundamentals: Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/sub tractor, multiplexers, De- multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.	7
5	Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram ofGSM system.	6

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Understand the principles of semiconductor devices and their applications.
CO2: Design an application using Operational amplifier.
CO3: Understand the working of timing circuits and oscillators.
CO4: Understand logic gates, flip flop as a building block of digital systems.
CO5: Learn the basics of electronic communication system.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design

system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	2	2	1	-	-	-	-	-	2	-	-	1	-	-
CO2	2	2	2	-	-	-	-	-	-	2	-	-	1	-	-
CO3	2	2	2	-	-	-	-	-	-	2	-	-	2	-	-
CO4	2	3	2	-	-	-	-	-	-	2	-	-	2	-	-
CO5	1	1	1	-	-	-	-	-	-	1	-	-	1	-	-
Avg	2	2	1.8	1	-	-	-	-	-	1.8	-	-	1.4	-	-

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **ES-ME301**	Category: **Engineering Science Courses**
Subject Name: **Engineering Mechanics**	Semester: **III**
L-T-P: **3-1-0**	Credit: **4**

Course Objectives:

1. To provide an introductory treatment of Mechanics to all the students of engineering with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters.
2. To provide a working knowledge of statics and dynamics with emphasis on force equilibrium and free body diagrams.
3. To determine a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to Engineering Mechanics covering, Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space —Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy;	3
2	Friction covering, Types of friction, Limiting friction, Lawsof Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;	4
3	Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;	4
4	Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition,Moment of inertia of plane sections from first principles, Theorems ofmoment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook;	5
5	Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium;	5
6	Review of particle dynamics- rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law, (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. impulse-momentum (linear, angular); Impact(Direct and oblique);	5
7	Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneouscentre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connectedbodies; Kinetics of rigid body rotation;	5
8	Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system,	5

	simple problems, types of pendulum, use of simple, compound and torsion pendulums;	
9	Tutorials from the above modules covering, to find the various forces and angles including resultants in various parts of wall crane, roof truss,pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Freebody diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack;	12

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.

CO2: Apply basic knowledge of maths and physics to solve real-world problems.

CO3: Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts).

CO4: Understand dynamics concepts – force, momentum, work and energy, the work-energy principle, impulse-momentum principle and the coefficient of restitution and solve dynamic problems.

CO5: Extend all of concepts of linear kinetics to systems in general plane motion (application of Euler's Equation) and get introduction to friction and vibration.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	1	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	3	1	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	3	1	-
Avg	3	2.8	1.2	-	-	-	-	-	-	-	-	1.2	2.6	1	-

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME301**	Category: **Professional Core courses**
Subject Name: **Thermodynamics**	Semester: **III**
L-T-P: **3-1-0**	Credit: **4**

Course Objectives:

1. To learn about work and heat interactions, and balance of energy betweensystem and its surroundings
2. To learn about application of I law to various energy conversion devices
3. To evaluate the changes in properties of substances in various processes
4. To understand the difference between high grade and low grade energies and IIlaw limitations on energy conversion.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependenceof displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.	5
2	Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.	5
3	Definition of Pure substance, Ideal Gases and ideal gas mixtures,Real gases and real gas mixtures, Compressibility charts- Propertiesof two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Useof steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.	8
4	First Law for Flow Processes - Derivation of general energy equationfor a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume.	5
5	Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.	5
6	Clausius inequality; Definition of entropy S ; Demonstration that entropy Sis a property; Evaluation of S for solids, liquids, ideal gasesand ideal gas mixtures undergoing various processes; Determinationof s from steam tables- Principle of increase of entropy; Illustration of processes in Ts coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability.	8

Course Outcomes:

CO1: After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions
CO2: Students can evaluate changes in thermodynamic properties of substances
CO3: The students will be able to evaluate the performance of energy conversion devices
CO4: The students will be able to differentiate between high grade and low-gradeenergies.
CO5: The students will be able to understand the concept of entropy generation.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

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CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	2	2	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	3	3	-	-	-	-	-	-	3	2	2	1
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	2	3	-	-	-	-	-	-	2	2	2	1
CO5	3	3	2	3	2	-	-	-	-	-	-	3	3	3	2
Avg	3	2.8	2.6	2.6	2.6	-	-	-	-	-	-	2.8	2.6	2.6	1.6

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME302**	Category: **Professional Core courses**
Subject Name: **Manufacturing Processes**	Semester: **III**
L-T-P: **4-0-0**	Credit: **4**

Course Objectives:

To motivate or challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Conventional Manufacturing Processes: Casting and moulding metal casting processes and equipment, Heat transfer and solidification, riser design, casting defects and residual stresses.	10
2	Introduction to bulk sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (Forging, rolling, extrusion, drawing) andsheet forming (shearing, deep drawing, bending) principles of powdermetallurgy.	10
3	Machining: Single and multi-point machining, Orthogonal Machining, cutting toolgeometry of STTP, milling cutter and Drill, Conversion of rake and clearance angle within ASA and ISO systems, Various forcecomponents, Chip formation, Tool wear and Tool life, surface finish and integrity, machinability, cutting tool materials. Cutting Fluids, Coating, Turning, Drilling, Milling and Finishing Processes, Introduction to CNC machining.	14
4	Joining/Fastening Processes: Physics of Welding, Brazing andSoldering; Design consideration in welding, Solid and Liquid state joining processes: Adhesive bonding.	8

Course Outcomes:

CO1: Upon completion of this course, students will be able to understand the different castingmethods and design the mould for making different products.

CO2: Students will be able to understand the different forming methods and force analysisfor making different products

CO3: Upon completion of this course, students will be able to understand different Machiningprocesses and cutting force analysis for different conventional machining processes.

CO4: Students will be able to understand different conventional and unconventional Joiningprocesses.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods

including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

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CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	2	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	3	2	2	1
CO3	3	3	3	3	2	-	-	-	-	-	-	3	3	3	2
CO4	3	2	2	3	3	-	-	-	-	-	-	3	2	2	1
Avg	3	2.75	2.75	2.5	2.75	-	-	-	-	-	-	3	2.5	2.5	1.5

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Course Code: **PC ME391**	Category: **Professional Core Courses**
Course Title: **Practice of Manufacturing Processes**	Semester: **III**
L-T-P: **0-0-3**	Credit**: 1.5**

Course Content:

About 12 practicing modules (1 module= 3Hour class a week) covering.

1. Machine Shop: Taper turning, drilling, boring, shaping and milling operations- 3 modules
2. Pattern Making: 1 or 2 wooden patterns to make- 2 modules
3. Moulding: 1 module
4. Smithy Shop: 1 module
5. Welding Shop: Practicing SMAW, Gas Welding and/or GMAW- 2 modules
6. Fitting Shop: 2 modules
7. Sheet Metal Shop: 1 module

Course Outcomes:

CO1: Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

CO2: They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

CO3: By assembling different components, they will be able to produce small devices of their interest.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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Program Specific Outcomes:

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CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	-	2	-	2	-	-	-	3	1	-	3	1	2	1
CO2	2	-	2	-	2	-	-	-	3	-	-	3	1	2	1
CO3	2	-	2	-	2	-	-	-	3	1	-	3	1	2	1
Avg	2	-	2	-	2	-	-	-	3	1	-	3	1	2	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **ES-ME401**	Category: **Engineering Science Courses**
Subject Name: **Materials Engineering**	Semester: **IV**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

1. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
2. To provide a detailed interpretation of equilibrium phase diagrams
3. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Crystal Structure: Unit cells, Metallic crystal structures, Ceramics.Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.	6
2	Mechanical Property measurement: Tensile, compression and torsiontests; Young's modulus, relations between true and engineering stress- strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.	6
3	Static failure theories: Ductile and brittle failure mechanisms, Tresca,Von- mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr- Coulomb; Fracture mechanics: Introduction to Stress-intensityfactor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to nondestructive testing (NDT)	8
4	Alloys, substitutional and interstitial solid solutions- Phase diagrams:Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and micro-structural aspects of ledeburite, austenite, ferrite and cementite, cast iron.	6
5	Heat treatment of Steel: Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering,martempering, case hardening, carburizing, nitriding, cyaniding, carbo- nitriding, flame and induction hardening, vacuum and plasma Hardening	6
6	Alloying of steel, properties of stainless steel and tool steels, maragingsteels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys	8

Course Outcomes:

CO1: Student will be able to identify crystal structures for various materials andunderstand the defects in such structures

CO2: Able to understand the defects in crystal structure.

CO3: Understand how to tailor material properties of ferrous and non-ferrous alloys

CO4: How to quantify mechanical integrity and failure in materials

CO5: Understand the different techniques of heat treatment of steel.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	2	2	2	2	-	-	-	-	-	-	3	3	3	2
CO2	3	2	2	2	3	-	-	-	-	-	-	3	2	2	1
CO3	3	2	2	3	3	-	-	-	-	-	-	3	3	3	2
CO4	3	3	3	3	3	-	-	-	-	-	-	2	2	2	1
CO5	3	3	2	3	3	-	-	-	-	-	-	3	3	3	2
Avg	3	2.4	2.2	2.6	2.8	-	-	-	-	-	-	2.8	2.6	2.6	1.6

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME401**	Category: **Professional Core courses**
Subject Name: **Applied Thermodynamics**	Semester: **IV**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

1. To learn about the 1st Law for reacting systems and heating value of fuels
2. To learn about gas and vapour cycles and their first law and second law efficiencies
3. To understand the properties of dry and wet air and principles of psychometry
4. To learn about gas dynamics of air flow and steam through nozzles
5. To learn about the reciprocating compressors with and without intercooling
6. To analyze the performance of steam turbines

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction solid, liquid and gaseous fuels – stoichometry, exhaust gas analysis, First law of analysis of combustion reactions- Heatcalculations using enthalpy tables – Adiabatic Flame Temperature. Chemical Equilibrium and equilibrium composition calculations using free energy	8
2	Vapor power cycles, Rankine cycles with superheat, Reheat and Regeneration. Exergy analysis. Super Critical and Ultra Super Critical. Rankine Cycle – Gas power cycles, Air Standard Otto, Diesel and Dual Cycles. Air Standard, Brayton Cycle, effects of reheat, regeneration and intercooling. Combined gas and vapour power cycles, refrigerants and their properties.	12
3	Properties of wet and dry air, use of psychometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.	4
4	Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic andsupersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation- Compressible flow in diffusers, efficiency of nozzle and diffuser.	8
5	Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum workfor multistage reciprocating compressors.	5
6	Analysis of steam turbines, velocity and pressure compounding ofsteam turbines	3

Course Outcomes:

CO1: Upon completion of this course, students will be able to understand the first law ofanalysis of combustion and do heat calculations using enthalpy tables.

CO2: Students will be able to solve various types of sums based on Vapour power cycleslike Rankine and Brayton cycle.

CO3: Upon completion of this course, students will be able to use psychometric charts andunderstand processes involving heating, humidification and dehumidification.

CO4: Students will be able to understand Compressible flow, Stagnation properties,isentropic flow through nozzles, sonic, hyper sonic and sub sonic flow.

CO5: Students will be able to understand and identify various types of compressors and doanalysis of steam turbines.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

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PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	1	2
CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	1	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3	1	2
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	1	2
Avg	3	3	3	3	3	-	-	-	-	-	-	3	3	1	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME402**	Category: **Professional Core courses**
Subject Name: **Fluid Mechanics & Fluid Machines**	Semester: **IV**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

1. To learn about the application of mass and momentum conservation laws for fluid flows
2. To understand the importance of dimensional analysis
3. To obtain the velocity and pressure variations in various types of simple flows
4. To analyze the flow in water pumps and turbines.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Definition of fluid, Newton's law of viscosity, Units and dimensions- Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications.	9
2	Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli, concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram.	9
3	Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis.	6
4	Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor,velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps- Reciprocating pump – working principle.	8
5	Classification of water turbines, heads and efficiencies, velocity triangles Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines.	8

Course Outcomes:

On successful completion of this course, student should be able to:

CO1: Upon completion of this course, students will be able to mathematically analyze simple flow situations

CO2: define basic terms, values and laws in the areas of fluids properties, statics, kinematics and dynamics of fluids, and hydraulic design of pipe systems;

CO3: describe methods of implementing fluid mechanics laws and phenomena while analyzing the operational parameters of hydraulic problems;

CO4: evaluate the performance of pumps and turbines.

CO5: calculate and optimize operational parameters of hydraulic problems;

Program Outcomes:

<u>Engineering Graduates will be able to:</u>

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design

system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

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PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	2	2	1	1	-	-	-	-	-	-	2	3	3	3
CO2	3	2	2	1	1	-	-	-	-	-	-	2	3	3	3
CO3	3	2	2	1	1	-	-	-	-	-	-	2	3	3	3
CO4	3	2	2	1	1	-	-	-	-	-	-	2	3	3	3
CO5	3	2	2	1	1	-	-	-	-	-	-	2	3	3	3
Avg	3	2	2	1	1	-	-	-	-	-	-	2	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME403**	Category: **Professional Core Courses**
Subject Name: **Strength of Materials**	Semester: **IV**
L-T-P: **3-1-0**	Credit: **4**

Course Objectives:

To understand the nature of stresses developed in simple geometries such as bars, cantilevers,beams, shafts, cylinders and spheres for various types of simple loads and to calculate the elastic deformation occurring in these simple geometries for different types of loading.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Deformation in solids – Hooke's law, stress and strain – tension, compression and shear stress – elastic constants and their relations – volumetric, linear and shear strains – principal stresses and principal planes – Mohr's circle;	8
2	Beams and types transvers loading on beams – shear force and bend moment diagrams – Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bendingstress distribution and neutral axis, shear stress distribution, point and distributed loads;	8
3	Moment of inertia about an axis and polar moment of inertia, deflectionof a beam using double integration method, computation of slopes anddeflection in beams, Maxwell's reciprocal theorems. Buckling of columns, Euler's theory, critical loads for different types of constraints;	10
4	Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection ofhelical springs;	8
5	Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shellssubjected to internal pressure;	8

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Understand the concepts of mechanics of deformable bodies.
CO2: Analyse different types of loading in different types of beams.
CO3: Analyse problems of slope and deflection in beams and columns.
CO4: Understand the concept of torsion in circular shafts and helical springs.
CO5: Understand the stress-strain distribution in thin and thick pressure vessels.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	3	2	-	-	-	-	-	-	-	-	1	1	1	-
CO2	3	2	3	-	-	-	-	-	-	-	-	1	1	2	-
CO3	3	2	3	-	-	-	-	-	-	-	-	1	1	2	-
CO4	3	2	3	-	-	-	-	-	-	-	-	1	1	2	-
CO5	3	2	3	-	-	-	-	-	-	-	-	1	1	2	-
Avg	2.8	2.2	2.8	-	-	-	-	-	-	-	-	1	1	1.8	-

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME404**	Category: **Professional Core courses**
Subject Name: **Metrology & Instrumentation**	Semester: **IV**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

1. To understand the working of linear and angular measuring instruments.
2. To familiarize with the working of optical measuring instruments and fundamentals oflimits and limit gauges.
3. To give basic idea about various methods for measurement of screw thread andsurface finish parameters.
4. To give an exposure to advanced measuring devices and machine tool metrology.
5. To provide students an overview of mechanical measurement systems and principle ofinstruments for motion and dimension measurement.
6. To provide basic idea about working principle and applications of devices formeasurement of force and torque; strain and stress and temperature.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Concept of measurement:-Introduction to Metrology; Need for high precision measurements; Terminologies in Measurement- Precision, accuracy, sensitivity, calibration, resolution. Errors in Measurement, types of errors, Abbe's Principle. Basic standards of length- Line standard, End standards, Wavelength standard; Various Shop floor standards. Linear Measurement – Slip gauges, wringing, grades; Surface plate; Dial indicators; Height gauges and Vernier calliper; screw gauge. Comparatorsmechanical, electrical, optical and pneumatic. Angular Measurement – Bevel protractor; Sine Bar, principle and use of sine bar, sine centre; Angle gauges. Sprit level; Angle Dekkor; Clinometers.	8
2	Limits and Limit gauges – Making to suit, selective assembly, systems of limits and fits; Types of fits; Hole basis system and Shaft basis system. Tolerance, allowance and deviation (as per BIS). Limit Gauges – GO and NO GO gauges; types of limit gauges. Gauge design - Taylor's principle of gauging; Gauge tolerance, disposition of gauge tolerance, wear allowance. Optical Measuring Instruments: -Benefits of light waves as standards; Monochromatic light; Principle of Interference. Interference band, optical flat, surface measurement. Interferometers – NPL, Pitter-NPL, auto collimator.	8
3	Screw thread measurement – Screw thread terminology; Measurement of major diameter; root diameter; pitch; effective diameter with two wire method and three wire method. Measurement of flank angle and form by profile projector and microscope. Measurement of surface texture – roughness and waviness; Analysis of surface traces, peak to valley height, R.M.S. value, Centre Line Average and Ra value, Rt, Rz etc. Methods of measuring surface roughness – Stylus probe, Tomlinson surface meter, Talysurf; surface roughness measurement – assessment length, roughness width cut-off, sampling length and evaluation length.	8
4	Introduction to Digital Measurement– significance of Digital measurement; methods; Classification. Stages in generalized measuring system– Sensor Transducer stage, Signal-Conditioning stage, Readout-Recording stage; Types of input quantities; Active and Passive transducers. Performance characteristic of measuring devices. Drift, Resolution, Threshold, Hysteresis, Static calibration. Dynamic characteristics- different order systems and their response-, Measuring lag, Fidelity, Dynamic error; Transducers– Working, Classification of transducers.	8

	Motion and Dimension measurement – LVDT – Principle, applications, advantages and limitations	
5	Strain and Stress Measurement- Electrical resistance strain gauge Principle, operation. Measurement of Force and Torque– Strain- Gauge Load Cells, Hydraulic and Pneumatic load cells– force measurement using piezoelectric quartz crystal. Torque Measurement– Dynamometers– Mechanical, Hydraulic and Electrical. Vibration measurement– Vibrometers and Accelerometers. Temperature Measurement– Use of Thermal Expansion– Liquid-in- glass thermometers, Bimetallic strip thermometer, Pressure thermometers. Thermocouples– Resistance Temperature Detectors (RTD); Thermistors; Pyrometers.	8

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Understand the working of linear and angular measuring instruments.

CO2: Know the fundamentals of limits and limit gauges, various methods for measurement of screw thread and surface roughness parameters and the working of optical measuring instruments.

CO3: Acquire an overview of mechanical measurement systems and principle of instruments for motion and dimension measurement.

CO4: Understand different instruments used in measurement system.

CO5: Get basic idea about working principle and applications of devices for measurement of force and torque; strain and stress and temperature.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	3	2	2	2	2	1	-	-	-	-	2	2	2	2
CO2	3	2	2	3	3	2	2	-	-	-	-	3	2	2	2
CO3	3	3	2	2	3	3	2	-	-	-	-	3	2	2	2
CO4	3	3	3	3	2	2	3	-	-	-	-	3	2	1	2
CO5	3	3	2	3	3	2	2	-	-	-	-	3	3	3	3
Avg	2.8	2.8	2.2	2.6	2.6	2.2	2	-	-	-	-	2.8	2.2	2	2.2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME491**	Category: **Professional Core courses**
Subject Name: **Practice of Manufacturing Processes and Systems Laboratory**	Semester: **IV**
L-T-P: **0-0-3**	Credit: **1.5**

Course Objectives:

1. To learn about the application of different pneumatics and/or electro-pneumatics components.
2. To understand the importance of electro-pneumatic actuators which are widely used to automate a number of areas of industrial applications, from production to assembly and packaging systems.
3. To learn about the application of hydraulics and electro-hydraulics systems.
4. To understand the importance of different measurement instruments like Sine Bar, micrometers, vernier protector etc.
5. To analyze the different surface texture by Talysurf instrument.

Course Content:

Module No	Description of Topic
1	Laboratory modules of pneumatics and/or electro-pneumatics
2	Laboratory modules of hydraulics and/or electro-hydraulics
3	Study of working of Logic Gates practically
4	Simulation of designed pneumatics / To learn about the application of
5	Measurement of surface roughness
6	Measurement of tapered objects using Sine Bar and using balls and rollers, etc.
7	Measurement of threads using three wire method
8	Measurement of gears
9	Measurement of bore diameter using micrometer and gauges
10	Measurement of angles using bevel vernier protractor
11	Statistical process control system to apply to measured dimension of samples
12	Practicing different gauges to assess angles, thread, internal and external radius, etc.

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Students will learn about the basic functions of pneumatics and electro-pneumatics system.
CO2: They will be able to analyze simulation of designed pneumatics.
CO3: They will learn about the Logic Gates practically.
CO4: They will be able to measurement of surface roughness.
CO5: They will be able to evaluate the measurement of tapered objects.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods

including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	2	2	2	2	1	2	-	-	-	-	2	2	1	2
CO2	2	3	3	3	3	2	2	-	-	-	-	2	2	2	2
CO3	3	2	2	2	3	2	2	-	-	-	-	3	2	2	2
CO4	3	3	3	2	3	2	2	-	-	-	-	3	3	2	2
CO5	3	3	2	3	3	3	2	-	-	-	-	3	3	2	3
Avg	2.6	2.6	2.4	2.4	2.8	2	2	-	-	-	-	2.6	2.4	1.8	2.2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME492**	Category: **Professional Core courses**
Subject Name: **Machine Drawing I**	Semester: **IV**
L-T-P: **0-0-3**	Credit:**1.5**

Course Objectives:

The student will acquire a knowledge of fastening arrangements such as welding, riveting the different styles of attachment for shaft. The student also is enabled to prepare the assembly of various machine or engine components and miscellaneous machine components.

Course Content:

Schematic product symbols for standard components in mechanical, electrical and electronic systems welding symbols and pipe Joints, Orthographic projections of machine elements, different sectional views full, auxiliary sections Isometric projection of components Assembly and detailed drawings of a mechanical assembly, such as a Plummer block, tool head of a shaping machine, tailstock of a lathe, simple gear box flange coupling, welded bracket joined by stud bot on to a structure, welded pipe joints indicating work parts before welding etc. Practicing AutoCAD or similar graphics software and making orthographic and isometric projections of different components

Course Outcomes:

On successful completion of this course, student should be able to:

CO1: Understand the product symbols used in drawing of components.

CO2: Understand the orthographic and isometric projections.

CO3: Understand the sectional views: full, half and auxiliary.

CO4: Apply the skills to draw assembly of mechanical components.

CO5: Apply graphics software to draw orthographic and isometric projections.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	-	-	-	1	-	-	-	-	-	-	1	-	3	1
CO2	3	-	-	-	1	-	-	-	-	-	-	1	-	3	1
CO3	3	-	-	-	1	-	-	-	-	-	-	1	-	3	1
CO4	3	-	-	-	1	-	-	-	-	-	-	2	-	3	1
CO5	2	-	-	-	3	-	-	-	-	-	-	1	-	3	1
Avg	2.8	-	-	-	1.4	-	-	-	-	-	-	1.2	-	3	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **MC 481**	Category: **Mandatory Courses**
Subject Name: **Environmental Science**	Semester: **IV**
L-T-P: **0-0-2**	Credit: **0**

Course Objectives:

To make the students aware of the environmental issues and help those to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues and acquire the skill to solve problem related to environment and pollution.

Course Content:

(a) Awareness Activities:

I. Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste

II. Slogan making event

III. Poster making event

IV. Cycle rally

V. Lectures from experts

(b) Actual Activities:

I. Plantation

II. Gifting a tree to see its full growth

III. Cleanliness drive

IV. Drive for segregation of waste

V. To live some big environmentalist for a week or so to understand his work

VI. To work in kitchen garden for mess

VII. To know about the different varieties of plants

VIII. Shutting down the fans and ACs of the campus for an hour or so

Course Outcomes:

CO1: Water Management

CO2: Waste Management

CO3: Treatment of wastes

CO4: Tree Plantation and Cleanliness Drives

CO5: Electricity Conservation

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

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CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	2	-	-	-	-	2	2	2	2	-	-	2
CO2	2	-	-	-		2	2	2	2	-	-	2
CO3	-	-	-	-	-	2	2	2	2	-	-	2
CO4	-	-	-	-	-	2	2	2	2	-	-	2
CO5	-	-	-	-	-	2	2	2	2	-	-	2
Avg	2	-	-	-	-	2	2	2	2	-	-	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME501**	Category: **Professional Core Courses**
Subject Name: **Heat Transfer**	Semester: **V**
L-T-P: **3-1-0**	Credit: **4**

Course Objectives:

1. The aim of the course is to build a solid foundation in heat transfer exposing students tothe three basic modes namely conduction, convection and radiation.
2. Rigorous treatment of governing equations and solution procedures for the three modeswill be provided, along with solution of practical problems using empirical correlations.
3. The course will also briefly cover boiling and condensation heat transfer, and the analysisand design of heat exchangers.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to three modes of heat transfer, Derivation of heat balanceequation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins-Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.	14
2	Heat convection, basic equations, boundary layers- Forced convection,external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convectionheat transfer- Correlations for forced and free convection- Approximate solutions tolaminar boundary layer equations(momentum and energy) for bothinternal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	10
3	Interaction of radiation with materials, definitions of radioactiveproperties, Stefan Boltzmann’s law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiativeproperties, view factors and the radiosity method.	9
4	Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and ε - NTU methods.	7
5	Boiling and Condensation heat transfer, Pool boiling curve.	4
6	Introduction to mass transfer, Similarity between heat and mass transfer.	4

Course Outcomes:

CO1: After completing the course, the students will be able to formulate and analyse aconduction type heat transfer problem

CO2: After completing the course, the students will be able to formulate and analyse aconvection type heat transfer problem

CO3: After completing the course, the students will be able to formulate and analyse aradiation type heat transfer problem

CO4: The students will be able to obtain exact solutions for the temperature variation usinganalytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer

CO5: The students will be able to design devices such as heat exchangers and also estimatethe insulation needed to reduce heat losses where necessary.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

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PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	3	2	1	1	-	-	-	-	2	3	2	3
CO2	3	3	3	3	2	1	1	-	-	-	-	2	3	2	3
CO3	3	3	3	3	3	1	1	-	-	-	-	2	3	2	3
CO4	3	2	3	2	3	-	-	-	-	-	-	3	2	3	2
CO5	3	3	3	2	2	-	-	-	-	-	-	3	2	2	2
Avg	3	2.8	3	2.6	2.4	1	1					2.4	2.6	2.2	2.6

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME502**	Category: **Professional Core Courses**
Subject Name: **Solid Mechanics**	Semester: **V**
L-T-P: **3-1-0**	Credit: **4**

Course Objectives:

The objective is to present the mathematical and physical principles in understanding the linearcontinuum behaviour of solids.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to Cartesian tensors, Strains: Concept of strain, derivationof small strain tensor and compatibility, Stress: Derivation of Cauchy relations and equilibrium and symmetry equations, principal stresses and directions;	12
2	Constitutive equations: Generalized Hooke's law, Linear elasticity, Material symmetry; Boundary Value Problems: concepts of uniquenessand superposition;	10
3	Plane stress and plane strain problems, introduction to governing equations in cylindrical and spherical coordinates, axisymmetric problems;	10
4	Application to thick cylinders, rotating discs, torsion of noncircular cross-sections, stress concentration problems, thermoelasticity, 2-D contact problems;	9
5	Solutions using potentials. Energy methods. Introduction to plasticity;	7

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Understand the concept of stress and strain in solid deformable bodies.

CO2: Develop relationships among stress, strain and deformation for linearly elastic solid andgenerate the governing equations in cartesian, cylindrical and spherical coordinates.

CO3: Solve plane stress and plane strain problems.

CO4: Solve asymmetric and axisymmetric, torsional, bending and thermoelastic problems.

CO5: Understand the properties of ideally plastic solid and apply the concepts of energy methodin solving structural problems.

Program Outcomes:

<u>Engineering Graduates will be able to:</u>

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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Program Specific Outcomes:

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CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	1	2	-	-	-	-	-	-	1	2	3	1
CO2	3	3	3	1	1	-	-	-	-	-	-	1	2	3	1
CO3	3	3	3	1	1	-	-	-	-	-	-	1	2	3	1
CO4	3	3	3	1	2	-	-	-	-	-	-	1	2	3	1
CO5	3	3	3	1	1	-	-	-	-	-	-	1	2	3	1
Avg	3	3	3	1	1.4	-	-	-	-	-	-	1	2	3	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME 503**	Category: **Professional Core Courses**
Subject Name: **Kinematics and Theory of Machines**	Semester: **V**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

1. To understand the kinematics and rigid- body dynamics of kinematically driven machinecomponents
2. To understand the motion of linked mechanisms in terms of the displacement, velocity andacceleration at any point in a rigid link
3. To be able to design some linkage mechanisms and cam systems to generate specifiedoutput motion
4. To understand the kinematics of gear trains

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains. Limit positions- Mechanical advantage- Transmission angle Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms.	6
2	Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics- Coincident points- Corioli's component of acceleration- introduction to linkage synthesis- three position graphical synthesis for motion and path generation.	7
3	Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent camspressure angle and undercutting, sizing of cams, graphical and analytical disc cam profilesynthesis for roller and flat face followers.	5
4	Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.	6
5	Surface contacts- sliding and rolling friction- friction drives bearings and lubrication, Friction clutches- Belt and Rope drives Friction in brakes.	6
6	Vibrations– Free and forced vibration of undamped and damped Single DOF systems, Resonance, Transmissibility Ratio, Effect of damping, Vibration Isolation, Critical Speed of Shafts.	6
7	Balancing of Reciprocating and Rotating Masses- Static balancing, Unbalance of force or moment, Dynamic balancing of rotating masses- graphical and analytical methods; Swaying couple; Hammer blow.	4
8	Governors- Use and classification; Study and analysis of Porter, Proell and Wilson-Hartnell governors; Sensitiveness, stability, isochronism, hunting, effort and power of governors.	3
9	Flywheel- Inertia force and inertia torque in reciprocating engine, correction couple (torque), Turning moment diagram and flywheel design.	3
10	Gyroscope- Gyroscopic couple and precessional motion, Effect ofgyroscopic couple on aeroplane and ship, Stability of two wheel and four wheel vehicles taking turn.	2

Course Outcomes:

CO1: To understand the kinematics and rigid- body dynamics of kinematically driven machine components

CO2: To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link

CO3: To be able to design some linkage mechanisms and cam systems to generate specified output motion

CO4: To understand the kinematics of gear trains

CO5: To understand the function of governor, flywheel and gyroscope

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

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CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	2	1	-	2	-	-	1	1	-	2	3	3	3
CO2	3	3	2	1	-	2	-	-	1	1	-	2	3	3	3
CO3	3	3	2	1	-	2	-	-	1	1	-	2	3	3	3
CO4	3	3	2	1	-	2	-	-	1	1	-	2	3	3	3
CO5	3	3	2	1	-	2	-	-	1	1	-	2	3	3	3
Avg	3	3	2	1	-	2	-	-	1	1	-	2	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **HM HU501**	Category: **Humanities and social science**
Subject Name: **Humanities I (Effective technical communication)**	Semester: **V**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. To help students develop basic proficiency in English Grammar, Vocabulary and Composition, and writing skills.
2. To help students identify common errors in writing and gain editing skills in the process.
3. To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs and emails.
4. To help students develop their respective personalities, values, ethics and attitudes, suitable enough for dealing with others in professional set ups

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media	7
2	Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technicalcommunication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization	8
3	Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity	6
4	Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.	8
5	Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving,Creativity	7

Course Outcomes:

On successful completion of this course, student should be able to:

CO1: Understand the dynamics of Verbal and Non-Verbal aspects of technical communication

CO2: Practice multi-step writing process to plan, draft, and revise reports, correspondence, andpresentations.

CO3: Illustrate and examine the knowledge of ethical aspects of engineering

CO4: Demonstrate and explain social and professional etiquettes

CO5: Plan self-development and practice self-assessment to function on multi-disciplinaryteams.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	-	2	-	2	-	1	-	2	1	3	1	3
CO2	-	-	1	1	-	1	-	2	-	3	-	3
CO3	-	2	2	2	-	2	1	3	3	3	2	3
CO4	-	2	1	-	-	-	1	3	2	3	-	3
CO5	-	1	1	1	-	1	1	3	1	3	1	3
Avg	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME-591**	Category: **Professional Core Courses**
Subject Name: **Mechanical Engineering Laboratory (Thermal) I**	Semester: **V**
L-T-P:**0-0-3**	Credit:**1.5**

Course Objectives:

1. To understand the principles and performance characteristics of flow and thermal devices.
2. To know about the measurement of the fluid properties.

Course Content:

Module No	Description of Topic
1	Measurement of coefficient of discharge of given Orifice and Venturi-meters
2	Determination of the density & viscosity of an oil and friction factor of oil flow in a pipe
3	Determination of the performance characteristics of a centrifugal pump
4	Determination of the performance characteristics of Pelton Wheel
5	Determination of the performance characteristics of a Francis Turbine
6	Determination of the performance characteristics of a Kaplan Turbine
7	Determination of the thermal conductivity and specific heat of given objects
8	Determination of the calorific value of a given fuel and its flash & fire points
9	Determination of the p-V diagram and the performance of a 4-stroke diesel engine
10	Determination of the convective heat transfer coefficient for flow over a heated plate
11	Determination of the emissivity of a given sample
12	Determination of the performance characteristics of a vapour compression system

Course Outcomes:

On successful completion of this course, student should be able to:

CO1: Students will be able to measure various properties of fluids

CO2: Students will be able to learn how fluid machines work.

CO3: They will be able to measure and learn how various types of heat transfer works and learn about their properties in depth.

CO4: They will be able to characterize the performance of fluid/thermal machinery.

CO5: They will be able to measure the characteristics of Refrigeration System.

Program Outcomes:

<u>Engineering Graduates will be able to:</u>

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	3	3	-	-	-	-	1	-	3	3	3	3
CO2	3	3	3	3	3	-	-	-	-	1	-	3	3	3	3
CO3	3	3	3	3	3	-	-	-	-	1	-	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	1	-	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	1	-	3	3	3	3
Avg	3	3	3	3	3	-	-	-	-	1	-	3	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME592**	Category: **Professional Core courses**
Subject Name: **Machine Drawing II**	Semester: **V**
L-T-P: **0-0-3**	Credit:**1.5**

Course Objectives:

Student will get methodically and well thought out presentation that covers fundamental issues common to almost all areas of machine drawing.

1. Students can have an ability to apply knowledge of Modeling, science & engineering.
2. Student can model this drawing even in CAD/CAM software by applying the basic knowledge of machine drawing.
3. Students will able to demonstrate an ability to design and conduct experiments, analyze and interpret data and assembly and disassembly drawings knowledge will be provided.

Course Content:

UNIT - I Projection and Isometric Drawing of Machine components

Fasteners: Drawings of various views of Screw threads, metric and BSW threads, square thread and multi start threads. Nut bolts, Washers, Setscrew, Locknuts and foundation bolts. Riveted joints: Forms and proportions of river heads, Different views of different types of riveted Lap and Butt joints.

Drawings of various views of Shaft joints: Cotter joint and Knuckle joint. Keys & Shaft coupling: Muff, Flanged, Flexible, Universal and Oldham's coupling.

UNIT - II Assignments using graphic software

Assembly and detailed drawings: Tool head of a shaping machine; Engine parts: Eccentric, Piston, Cross head and Connecting rod; Valves: Steam stop valve, Anyone of safety, relief and non-return valves; Solid modeling of Plummer block.

Course Outcomes:

On successful completion of this course, student should be able to:

CO1: Apply the skills to draw views of threaded components.
CO2: Apply the skills to draw riveted joints.
CO3: Apply the skills to draw views of shaft joints.
CO4: Apply graphics software to draw assembly drawings.
CO5: Apply graphics software for solid modelling.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

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PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	-	2	-	2	-	-	-	-	-	-	2	2	3	1
CO2	2	-	2	-	2	-	-	-	-	-	-	2	2	3	1
CO3	2	-	2	-	2	-	-	-	-	-	-	2	2	3	1
CO4	2	-	2	-	2	-	-	-	-	-	-	2	2	3	1
CO5	2	-	2	-	2	-	-	-	-	-	-	2	2	3	1
Avg	2	-	2	-	2	-	-	-	-	-	-	2	2	3	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PW-ME 581**	Category: **Project (Summer internship)**
Subject Name: **Project-I**	Semester: **V**
L-T-P: **0-0-2**	Credit: **1**

Course Objectives:

This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Gather some exposure on some projects,
CO2: Understand the procedure to carry out practical projects related to any technical event/ competition
CO3: Designing some innovative ideas
CO4: Fabricating and/or demonstrating an innovative machine or product.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

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PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	-	-	-	-	-	2	2	2	-	-	2	1	-	1	-
CO2	2	2	2	1	2	-	-	-	2	2	1	1	-	1	-
CO3	3	3	3	2	3	3	3	-	2	-	2	2	3	3	3
CO4	3	3	3	1	1	-	-	-	2	2	-	2	-	2	1
Avg	2.67	2.67	2.67	1.33	2	2.5	2.5	2	2	2	1.67	1.50	3	1	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME601**	Category: **Professional Core courses**
Subject Name: **Manufacturing Technology**	Semester: **VI**
L-T-P: **4-0-0**	Credit:**4**

Course Objectives:

To impart knowledge to make students able to demonstrate the tooling needed for manufacturing, the dimensional accuracy and tolerances of products, assembly of different components. Also students will be able to understand the principles of working of NC, CNC machine tools and rapid prototyping.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Tooling for conventional and non-conventional machining processes: Mould and die design, Press tools, Cutting tools; Holding tools: Jigs and fixtures, principles, applications and design; Press tools: Configuration, design of die and punch; principles of forging diedesign.	12
2	Metrology: Metrology in tool wear and part quality including surface integrity, alignment and testing methods; tolerance analysis in manufacturing and assembly. Process metrology for emerging machining processes such as micro-scale machining, Inspection and work piece quality.	8
3	Assembly practices: Manufacturing and assembly, process planning,selective assembly, Material handling and devices.	6
4	NC/CNC Machine Tools and Systems Types of automation: Fixed (or hard) and programmable (or flexible); need, advantages and applications of flexible automation over fixed automation. Components and Their Functions in NC/CNC Machines. MCU, DPU and CLU, Feed drives using stepper/ servo motors and recirculating ball screw-nut system, Automatic Tool Changers- Tool Turret and Tool Magazine, Automatic pallet Changer. Basic systems of NC and CNC machines. Coordinate system, Control– open loop and closed loop, Dimensioning– absolute and incremental, Point–to–point and contour motion, Linear and circular Interpolation. CNC Machine Tools and Integrated Automation Structure and working principle of CNC lathe, milling machine, Examples and use of CNC machines, Machining Centre (Vertical and Horizontal), Integrated Automation systems (DNC- Direct andDistributed or BTR and Dedicated system, FMS- FFMS, FMC and FMM)– characteristics and applications.	8
5	Part Programming for CNC machines Manual Part Programmingusing ISO G and M Codes in CNC lathe and milling machine for simple jobs, Canned cycle. Computer Aided Part Programming using MACRO statements in APT for simple jobs in CNC lathe and milling machine.	8
6	Rapid Prototyping Overview of Rapid Prototyping, Basic Process- CAD Model Creation, Conversion to STL format, Slicing the STL File, Layer by layer construction. Use of CMM and 3-D Camera for making virtual model. Principles, systems, relative advantages and applications of the common RP methods, such as Stereo lithography (SLG), Selective laser sintering (SLS), Fused deposition modelling (FDM), Laminated objects manufacturing (LOM), 3-D Printing.	6

Course Outcomes:

Upon successful completion of the course, student will have

CO1: To describe machines and related tools for manufacturing various components.

CO2: To understand the relationship between process and system in manufacturing domain.

CO3: To understand the cutting tool development.

CO4: To experiment on CNC machine tools.

CO5: To demonstrate rapid prototyping methods.

Program Outcomes:

Engineering Graduates will be able to:

PO1:	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.
PO2:	Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3:	Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4:	Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5:	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.
PO6:	The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice
PO7:	Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8:	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9:	Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.
PO10:	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11:	Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
PO12:	Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1	:	Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
PSO 2	:	Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.
PSO 3	:	Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	2	1	2	2	1	2	-	-	-	-	2	2	2	1
CO2	2	3	2	3	3	2	2	-	-	-	-	2	2	2	2
CO3	3	3	3	2	3	2	2	-	-	-	-	3	2	2	2
CO4	3	2	3	3	3	2	2	-	-	-	-	3	2	2	2
CO5	3	3	2	3	3	3	2	-	-	-	-	3	3	2	3
Avg	2.6	2.6	2.2	2.6	2.8	2	2	-	-	-	-	2.6	2.2	2	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME602**	Category: **Professional Core Courses**
Subject Name: **Design of Machine Elements**	Semester: **VI**
L-T-P: **3-1-0**	Credit: **4**

Course Objectives:

This course seeks to provide an introduction to the design of machine elements commonly encountered in mechanical engineering practice, through

1. a strong background in mechanics of materials-based failure criteria underpinning thesafety-critical design of machine components.
2. an understanding of the origins, nature and applicability of empirical design principles,based on safety considerations
3. an overview of codes, standards and design guidelines for different elements.
4. an appreciation of parameter optimization and design iteration.
5. an appreciation of the relationships between component level design and overallmachine system design and performance.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Objective and scope of Mechanical Engineering Design; Design considerations; Review and selection of materials and manufacturing processes; codes and standards;	4
2	Modes of failure; Design/allowable stress; Factor of safety (FoS); Theories of failure – maximum normal stress theory, maximum shear stress theory, Distortion energy theory. Choice of Failure criteria; Design for stability: buckling analysis – Johnson and Euler columns;	4
3	Fatigue in metals; S-N curve; Endurance limit and fatigue strength; Stress concentration factors – effect of discontinuity, fillets and notches; Effect of size, surface finish, stress concentration and degree of reliability on endurance limit; Design for finite and infinite life; Goodman, modified Goodman and Soderberg diagrams with respect tofatigue failure under variable stresses; Cumulative fatigue damage – Miner's equation;	5
4	Design of (i) Cotter joint; (ii) Knuckle joint and (iii) Fillet Welded jointof brackets under different types of loading;	6
5	Bolted joints: Metric thread, standard sizes, use of lock nuts and washers; Applications in structures including brackets, turn buckle; pre-stressed bolts; Riveted joints: Unwin's formula; Brief discussion on single, double and triple row lap joints, butt joints with single or double strap / cover plate; simple strength design; joint efficiencies;	6
6	Design of: (i) Solid and hollow shafts, strength design of shafts, designbased on torsional rigidity; (ii) Shaft coupling-rigid, pin-bush andgeared flexible type, alignment of coupling; (iii) Belt drives-geometrical relations, derivation of torque and power transmission by flat and V-belt drives, selection of belt from manufacturers' catalogues,pulley (iv) Chain drives – roller chains, polygonal effect, power rating,sprocket wheel, silent chain;	10
7	Design of: (i) Transmission screw, Screw jack, (ii) Helical compressionspring - stress and deflection equations, stiffness, curvature effect: Wahl's factor, springs in parallel and series; (iii) multi-leaf springs: load-stress and load-deflection equations, Nipping;	8
8	Analysis and design of sliding and rolling contact bearings, Design of transmission elements: spur, helical, bevel and worm gears; Analysis of clutches and brakes;	5

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Get an overview of the design methodologies employed for the design of various machine elements.

CO2: Understand the theories of failure to design and analyse various mechanical components.

CO3: Recognize and apply the concept of fatigue phenomenon in design of components undergoing cyclic loading.

CO4: Understand the importance of factor of safety applying the same in designing.

CO5: Analyse and solve various problems related to design of machine elements.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	1	2	-	-	-	-	-	-	-	-	1	3	2	1
CO2	3	2	3	-	-	-	2	-	-	-	-	1	2	2	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	2	2
CO4	3	1	3	-	-	-	2	-	-	-	-	1	3	3	2
CO5	3	2	2	-	3	-	-	-	-	-	-	3	2	3	2
Avg	2.8	1.6	2.4	-	3	-	2	-	-	-	-	1.4	2.4	2.4	1.6

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE-ME601A**	Category: **Professional Elective courses**
Subject Name: **IC engines and gas turbines**	Semester: **VI**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

To acquire knowledge about the IC engine cycles, classification, working Principlesand to measure performance parameters along with heat balance sheet.
To explain different alternate fuels, gas turbines and about jet propulsion.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction:** Basic Engine components and Nomenclature, Classification of Engines, The working principle of Engines, Comparison of 2-Stroke and 4-Stroke Engines; CI, and SI Engines, Ideal and Actual Working Cycles and their analysis, Valve timing Diagram. **Fuels:** Fossil fuels, Chemical structure of Petroleum, Properties of SI and CI Engine Fuels, Fuel Ratings; Octane Number, Cetane Number.	6
2	**Carburetors & Fuel Injection:** Air Fuel Mixture Requirements, Construction and Working of Simple Carburetor, Calculation of Air-Fuel Ratio, Parts of Carburetor. Requirement of Injection Systems, Classification of Injection Systems, Fuel Feed pump, Injection Pumps, Working principles of Governors, Nozzles and Fuel Injector, Injection in SI and CI Engines. **Combustion and Ignition Systems in SI and CI Engines:** Normal and Abnormal Combustion in SI and CI Engines, Stages of Combustion, Detonation and Knocking.	7
3	**Performance parameters for IC Engines:** Engine Power, Engine Efficiencies, Performance Characteristics, Variables Effecting Performance Characteristics, Methods of Improving Engine Performance, Heat Balance. **Modern Automotive Engines:** Changes in Fuel injection Methods in S.I and C.I engines, Common Rail Direct Injection System, Gasoline Direct Injection, Variable Valve Technology, A brief review of Design changes to achieve high efficiency.	7
4	**Alternate Fuels For IC Engines:** Need for use of alternate fuels. Use of alcohol fuels. Biodiesel. **Biogas and Hydrogen in engines.**	3
5	**Gas Turbine:** Introduction to Gas Turbines, Development, Classification and Application of Gas Turbines, Ideal and Actual Cycles; Effect ofInter cooling, Reheating, Regeneration, Combined cycle and Cogeneration.	6
6	**Gas Turbine Cycles for Aircraft Propulsion:** Criteria of performance, Intake, and propelling nozzle efficiencies,Simple Turbojet Cycle, The turboprop engine, Thrust augmentation, Gas turbine combustion systems, Combustion chamber designs, Gas Turbine Emissions.	7

Course Outcomes:

CO1: Explained basic concepts of actual cycles with analysis and to describe thefundamental concepts of IC engines along with its working principles.
CO2: Described the combustion phenomenon in SI and CI engines.
CO3: Evaluated the performance of IC engines and the importance of alternate fuels.
CO4: Classified the essential components of gas turbine along with its performance improving methods.
CO5: Illustrated the working principle of different types of Jet propulsive engines andRockets.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	2	3	2	-	-	-	-	-	-	3	3	3	2
CO2	3	3	2	3	2	-	-	-	-	-	-	3	2	2	1
CO3	2	2	2	2	3	-	-	-	-	-	-	3	3	3	2
CO4	3	3	2	3	2	-	-	-	-	-	-	2	2	2	1
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3	3	2
Avg	2.8	2.8	2.2	2.8	2.4	-	-	-	-	-	-	2.8	2.6	2.6	1.6

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE-ME602B**	Category: **Professional Elective courses**
Subject Name: **Refrigeration and Air conditioning**	Semester: **VI**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

1. To know about the basics of refrigeration and air-conditioning system.
2. To learn about different types of Refrigeration, Air-Conditioning and ventilationsystems.
3. To know about designing a Refrigeration and Air-Conditioning system.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction: Concepts of Refrigeration and Air-Conditioning. Unit of refrigeration, Refrigerants– Desirable Properties, Nomenclature	2
2	Simple Vapour Compression Refrigeration System (Simple VCRS): Vapour compression cycle on p-h and T-s diagrams. Cycles withsubcooling and superheating, their effects; Effect of changes in evaporator pressure and condenser pressure on the performance of a simple VCRS; dry compression and wet compression of refrigerant; actual Vapour Compression Cycle.	5
3	Air Refrigeration System (ARS): Bell-Coleman refrigerator. COP determination, actual air-refrigeration cycle.	3
4	Vapour Absorption Refrigeration System (VARS): Advantages ofVARS over VCRS. Working principle of simple VARS, practical VARS. Limitations of VARS, maximum COP of a VARS, Lithiumbromide-water System; Aqua-ammonia systems.	4
5	Equipment and Control: Major Refrigeration Equipment- Compressors: Types; reciprocating, rotary & centrifugal, volumetric efficiency, Condensers: types used in refrigeration systems; Evaporators: expansion devices: capillary tubes and thermostatic expansion valves.	6
6	Ventilation– Definition & Requirement, Natural & Mechanical Ventilation, Ventilation Load Calculation.	3
7	Basic definitions and principles related to Psychometry; PsychometricCharts & Their Uses; Heating, Cooling, Heating & Humidification & Cooling & Dehumidification processes. Adiabatic Saturation, Cooling Coils, By-pass Factor.	5
8	Sensible Heat Factors. Heat Load estimation: Simple cases of Cooling and Dehumidification. Duct Sizing & Design. Air-conditioning equipment: Air handling units, Cooling Towers.	8

Course Outcomes:

After completing this course, the students will

CO1: know about the systems of Refrigeration, Air-Conditioning and Ventilation.
CO2: learn about different components of VCRS systems.
CO3: learn about different components of Vapour absorption refrigeration systems.
CO4: Know about the principles related to Psychometry
CO5: know about designing a Refrigeration and Air-Conditioning system.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and

engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	3	3	-	-	-	-	2	3	3	3	3	3
CO2	3	3	3	2	3	-	-	-	-	2	3	3	3	3	3
CO3	3	3	2	3	3	-	-	-	-	2	3	3	3	3	3
CO4	3	3	3	3	3	-	-	-	-	2	3	3	3	3	3
CO5	3	3	3	3	3	-	-	-	-	2	3	3	3	3	3
Avg	3	3	3	2.8	3	-	-	-	-	2	3	3	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE ME602H**	Category: **Professional Elective Courses**
Subject Name: **Robotics**	Semester: **VI**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:
To impart knowledge about the engineering aspects of Robots and their application.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction: Basic concepts- Robot anatomy- Manipulators- kinematics: Forward and inverse kinematics- Precision movement, robot specifications and Work volume, Types of Robot drives- Basic robot motions- Point to point control, continuous path contour.	8
2	End Effectors: End effectors- classification- mechanical, magnetic, vacuum and adhesive gripper- gripper force analysis and design. Robot control- Unit control system concept- servo and non-servo control of robot joints, adaptive and optimal control.	7
3	Sensors: Sensor devices, Types of sensors- contact, position and displacement sensors, Force and torque sensors- Proximity and range sensors- acoustic sensors- Robot vision systems- Sensing and digitizing- Image processing and analysis.	6
4	Robot Programming: Robot language classification- programming methods- off and on line programming- Lead through method- Teach pendent method- VAL systems and language, simple program.	8
5	Industrial Application: Application of robots- Material handling- Machine loading and unloading, Assembly, Inspection, Welding, Spray painting, Mobile robot, Microbots- Recent developments in robotics- safety consideration.	7

Course Outcomes:

CO1: To familiarize the Basics of the robots Control system.
CO2: To familiarize the end effectors, Sensor technology, and Industrial application of Robots.
CO3: Design and fabricate simple grippers for pick and place applications.
CO4: Differentiate the various types of Industrial Robots and their architecture.
CO5: Apply the concepts of image processing for robotic inspection systems.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	3	2	2	2	1	1	-	-	-	-	2	2	1	2
CO2	3	3	3	3	3	2	2	-	-	-	-	2	2	2	2
CO3	3	2	2	2	2	2	2	-	-	-	-	2	2	2	2
CO4	2	3	2	2	3	2	2	-	-	-	-	3	2	1	2
CO5	3	3	2	3	3	3	2	-	-	-	-	3	3	3	3
Avg	2.6	2.8	2.2	2.4	2.6	2	1.8	-	-	-	-	2.4	2.2	1.8	2.2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **HM-HU601**	Category: **Humanities and Social Sciences including Management Courses**
Subject Name: **Humanities II (Operations Research)**	Semester: **VI**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

To motivate or challenge students to understand the concepts of transportation problem, assignment problem, CPM –PERT, formulation of Graphical problem and solve the problem of Queuing theory.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction to Operations Research**: Introduction, Historical Background, Scope of Operations Research, Features of Operations Research, Phases of Operations Research, Types of Operations Research Models, Operations Research Methodology, Operations Research Techniques and Tools, Structure of the Mathematical Model, Limitations of Operations Research	2
2	**Linear Programming:** Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Case Studies of LPP,Graphical Methods to Solve Linear Programming Problems, Applications, Advantages, Limitations. Graphical Analysis of Linear Programming Problems: Introduction, Graphical Analysis, Some Basic Definitions, Graphical Methods to Solve LPP, Some Exceptional Cases, Important Geometric Properties of LPP. Simplex Method: Introduction, Standard Form of LPP, Fundamental theorem of LPP, Solution of LPP - Simplex Method, The Simplex Algorithm, Penalty Cost Method or Big M-method, Two Phase Method, Solved Problems on Minimisation. Duality in Linear Programming Problem: Introduction, Importance of Duality Concepts, Formulation of Dual Problem, Economic Interpretation of Duality, Sensitivity Analysis.	8
3	**Transportation Problem:** Introduction, Formulation of Transportation Problem (TP), Transportation Algorithm (MODI Method), the Initial Basic Feasible Solution, Moving Towards Optimality	3
4	**Assignment Problem:** Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Travelling Salesman Problem	3
5	**Project Management Using CPM-PERT:** Project Scheduling and PERT-CPM: Introduction, Basic Difference between PERT and CPM, PERT/CPM Network Components and Precedence Relationship, Project Management – PERT, Float calculation and its importance. Cost reduction by Crashing of activity	5
6	**Queuing Theory:** Basis of Queuing theory, elements of queuing theory, Operating characteristics of a queuing system, Queue discipline, Service Mechanism, Classification of Queuing models, [M/M/1]:{//FCFS} Queue System, numerical	3
7	**Inventory Management:** Inventory classification, Different costs associated to Inventory, Inventory models with deterministic demands (EOQ, EPQ and price discount models), inventory classification systems	4
8	**Job Sequencing**: Introduction to sequencing and scheduling models: n job two machines problem, n job 3 machines problem	2
9	**Decision Theory:** Introduction, Decision under certainty, Decision under risk, Decision under uncertainty: Laplace criterion, MaxiMin criterion, MiniMax criterion, savage MiniMax regret criterion, Hurwicz criterion, Decision tree	3
10	**Replacement Theory:** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy	3

Course Outcomes:

CO1: Set up decision models and use some solution methods for finding solutions of problems. andto formulate and apply LPP and solution of LPP by Graphical Method and Simplex Method.

CO2: Methods of solving Transportation Problems and Assignment Problems.

CO3: To develop the network and to find the shortest path, critical path using PERT and CPM method, maximal flow of Network analysis by Floyd's Algorithm and Fulkerson's Algorithm

CO4: To develop the modelling and mathematical skills to analytically determine queuing modelsand finding various parameters associated with the model and applications of some real life situations.

CO5: Introduction to Non Linear Optimization and some methods of solving NLPP.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping												
	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	-	2	3	3	-	-	-	-	-	-	3	3
CO2	-	3	3	2	-	-	-	-	-	-	3	3
CO3	-	3	3	3	-	-	-	-	-	-	3	3
CO4	-	3	2	3	-	-	-	-	-	-	3	3
CO5	-	2	2	3	-	-	-	-	-	-	3	3
Avg	-	2.6	2.6	2.8	-	-	-	-	-	-	3	3
1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation												

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **MC 601**	Category: **Mandatory Courses**
Subject Name: **Constitution of India**	Semester: **VI**
L-T-P: **0-2-0**	Credit: **0**

Course Objectives:

The objectives of this course help the students to

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	4
2	Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	5
3	State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91st Amendments.	5
4	Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights. Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchayats and Co - Operative Societies.	5
5	Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchayats and Co - Operative Societies.	5

Course Outcomes:

After completion of the course, students will be able to:

CO1: Have general knowledge and legal literacy and thereby to take up competitive examinations.
CO2: Understand state and central policies, fundamental duties.
CO3: Understand Electoral Process, special provisions.
CO4: Understand powers and functions of Municipalities, Panchayats and Co-operative Societies,
CO5: Understand Engineering ethics and responsibilities of Engineers

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	-	-	-	-	-	-	1	-	-	-	-	2
CO2	-	-	-	-	-	-	2	2	-	-	-	2
CO3	-	-	-	-	-	-	2	3	-	-	-	2
CO4	-	-	-	-	-	-	2	-	-	-	-	2
CO5	-	-	-	-	-	-	2	3	-	-	-	2
Avg	-	-	-	-	-	-	2	1.6	-	-	-	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME691**	Category: **Professional Core courses**
Subject Name: **Mechanical Engineering Laboratory (Design) II**	Semester: **VI**
L-T-P: **0-0-3**	Credit:**1.5**

Course Objectives:

1. To understand the measurement of mechanical properties of materials
2. To understand the deformation behaviour of materials
3. To understand the kinematic and dynamic characteristics of mechanical devices

Course Content:

1. Uniaxial tension test on mild steel rod
2. Torsion test on mild steel rod
3. Impact test on a metallic specimen
4. Brinell/ Vickers and Rockwell hardness tests on metallic specimens
5. Bending deflection test on beams
6. Strain measurement using Rosette strain gauge, or like.
7. Microscopic examination of heat-treated and untreated metallic samples
8. Determination of velocity ratios of simple, compound, epicyclic and differential gear trains
9. Studying kinematics of four bar, slider crank, crank rocker, double crank, double rocker and oscillating cylinder mechanisms
10. Studying kinematics of typical mechanisms like pantograph, some straight-line motion mechanisms, wiper, drafter, etc.
11. Motion studies of different cams & followers
12. Single degree of freedom Spring-mass-damper system: determination of natural frequency and damping coefficient
13. Determination of torsional natural frequency of single and double rotor systems undamped and damped natural frequencies
14. Studying machine vibration using sensor
15. Solving simple balancing problems experimentally

Course Outcomes:

On successful completion of this course, student should be able to:

CO1: Determine the strength properties of a material.

CO2: Determine the strain and deflection of a material.

CO3: Describe the physical structure of a heat-treated metallic component.

CO4: Solve dynamics problems experimentally.

CO5: Examine various vibration problems.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1
CO3	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1
CO5	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1
Avg	2	1	-	-	-	-	-	-	-	-	-	1	2	1	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PW-ME 681**	Category: **Project (Summer Internship)**
Subject Name: **Project-II**	Semester: **VI**
L-T-P: **0-0-4**	Credit: **2**

Course Objectives:

This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Gather some exposure on some projects,

CO2: Understand the procedure to carry out practical projects related to any technical event/ competition

CO3: Designing some innovative ideas

CO4: Fabricating and/or demonstrating an innovative machine or product.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	-	-	-	-	-	2	2	2	-	-	2	1	-	1	-
CO2	2	2	2	1	2	-	-	-	2	2	1	1	-	1	-
CO3	3	3	3	2	3	3	3	-	2	-	2	2	3	3	3
CO4	3	3	3	1	1	-	-	-	2	2	-	2	-	2	1
Avg	2.67	2.67	2.67	1.33	2	2.5	2.5	2	2	2	1.67	1.50	3	1	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME701**	Category: **Professional Core Courses**
Subject Name: **Advanced Manufacturing Technology**	Semester: **VII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To introduce principles of material removal mechanism of advanced machining processes such as mechanical, electro-chemical and thermal.
To give basic understanding of the machining capabilities, limitations, and productivity of advanced manufacturing technologies.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Mechanical Advanced Machining Processes:** Need and classification of nontraditional machining processes – Material removal in traditional and nontraditional machining processes - considerations in process selection. Ultrasonic machining – Working principle, mechanism of metal removal – Theory of Shaw, elements of the processes, tool feed mechanism, effect of parameters, applications and numerical. Abrasive jet machining, Water jet machining and abrasive water jet machine - Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations.	6
2	**Electro–Chemical Processes:** Principle of ECM process, chemistry of the ECM processes, Parameters of the process, determination of the metal removal rate, dynamics of ECM process, polarization, tool design, advantages and disadvantages, application, electrochemical grinding, electrochemical honing, electrochemical deburring, Application of ECM for deep hole drilling - electrostream drilling and shaped tube electrolytic machining. Chemical machining - Fundamental principle, types of chemical machining, maskants, etchants, advantages, disadvantages, applications	6
3	**Electric Discharge Machining:** Working principle of EDM, Power circuits for EDM - RC pulse generator and controlled pulse generator– Analysis of R-C Circuits – Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface and recent development in EDM. Wire EDM – Working principle, process variables, process characteristics and applications. Electric discharge grinding and electric discharge diamond grinding - working principle, process capabilities and applications.	6
4	**Laser, Electron Beam, Ion Beam and Plasma Arc Machining:** General working principle of laser beam machining – Generation of Laser, types of Lasers, process characteristics and applications. Electron Beam Machining - Equipment for production of Electron Beam, theory of EBM, thermal and non-thermal type, process characteristics and applications. Ion Beam Machining - Mechanism of metal removal and associated equipments, process characteristics and applications. Plasma Arc Machining - Metal removal mechanism, process parameters, process characteristics, types of torches, applications.	6
5	**Advanced Finishing Processes:** Abrasive flow Machining (AFM)- working principle, AFM system, process variables, process performance and applications. Magnetic abrasive finishing (MAF)- working principle, MAF system, material removal and surface finish, process variables and applications. Chemomechanical polishing, working principle, material removal and surface finish and applications.	6

6	**Micro-Machining:** Need- evolution- fundamentals and trends in micro technologies- Consequences of the technology and society- challenges to manufacturing technology- evolution of precision in manufacturing, tooling and current scenario, requirements and applications Theory of micromachining- Chip formation- Size effect in micromachining- microturning- microdrilling.	6

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: To understand non- traditional machining processes and the effect of process parameters
CO2: To differentiate the various non-traditional machining processes
CO3: To demonstrate micromachining technology
CO4: To understand different advanced cutting tools and its applications.
CO5: Know about the different program like APT, CNC program.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

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PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	2	1	1	2	1	1	-	-	-	-	2	2	1	1
CO2	2	3	2	3	3	2	2	-	-	-	-	2	2	2	2
CO3	3	2	2	2	3	2	1	-	-	-	-	2	2	2	2
CO4	3	3	2	2	3	2	2	-	-	-	-	3	2	1	2
CO5	3	3	2	3	3	3	2	-	-	-	-	3	3	2	3
Avg	2.6	2.6	1.8	2.2	2.8	2	1.6	-	-	-	-	2.4	2.2	1.6	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE ME701A**	Category: **Professional Elective Courses**
Subject Name: **Automobile Engineering**	Semester: **VII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To impart knowledge on various types of power-driven vehicles and to familiarize the studentswith the fundamentals of Automotive Engine System, Chassis and suspension system, braking and transmission system, and cooling system.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction:** History & Development of Automobile. Various sub systems ofAutomobile.	1
2	**Prime Mover:** Engine for Two-Wheeler & Three-Wheeler vehicles, Engine for passenger cars, commercial and other vehicle, Fuel system for carburetted engine, MPFI engine and Diesel engine, Lubrication and cooling system.	5
3	**Auto Electrical:** Electric Motor as prime mover, Battery, generator, Ignition system, Starting system, lighting & signaling	6
4	**Steering System:** Davis steering & Ackerman steering system. Rack & pinion, cam & lever, worm & sector system.	3
5	**Transmission System:** Flywheel & clutch. Gearbox sliding and constant mesh type, Automatic Transmission, Universal joint, Propeller shaft.	6
6	**Differential & Axle:** Construction & function of differential, Different types of front & rear axles.	3
7	**Suspension System:** Conventional and independent suspension system, application.	3
8	**Brake System:** Disc & drum brake, Hydraulic brake, Parking brake. Stopping distance.	3
9	**Power Requirement:** Various resistances such as air resistance, gradient resistance, rolling resistance. Tractive effort. Torque- Speed curve. Horse power calculation.	3
10	**Automotive air conditioning:** Ventilation, heating, air condition, refrigerant, compressor and evaporator. **Wheels and tyres:** Wheel quality, assembly, types of wheels,wheel rims. Construction of tyres and tyre specifications. **Automotive Restraint Systems:** Seat belt, automatic seat belt tightener system, collapsible steering column and air bags.	3

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the basic lay-out of an automobile.

CO2: Explain the operation of engine cooling, lubrication, ignition, electrical and air conditioningsystems.

CO3: Illustrate the principles of transmission, suspension, steering and braking systems.

CO4: Demonstrate automotive electronics.

CO5: Study latest developments in automobiles.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	2	3	2	3	-	-	-	-	-	-	3	3	3	2
CO2	3	3	3	3	2	-	-	-	-	-	-	3	2	2	2
CO3	2	3	3	2	2	-	-	-	-	-	-	3	3	2	2
CO4	3	2	2	2	3	-	-	-	-	-	-	3	2	2	2
CO5	2	2	3	3	3	-	-	-	-	-	-	3	3	3	2
Avg	2.4	2.4	2.8	2.4	2.6	-	-	-	-	-	-	3	2.8	2.4	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE ME702E**	Category: **Professional Elective Courses**
Subject Name: **Selection and Testing of Materials**	Semester: **VII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

The subject exposes students to the basic parameter for selection of materials and different classes of materials, and various destructive and non-destructive testing methods of materials and its industrial applications.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Engineering Materials** Introduction – classification of engineering materials – selection ofmaterials for engineering purposes –selection of materials and shape –classification metal and alloys, polymers, ceramics and glasses,composites, natural materials,-non metallic materials- smart materials - physical, metrical properties of metals.	5
2	**Material Properties** Mechanical properties - fatigue strength - fracture Toughness - Thermal Properties - Magnetic Properties - Fabrication Properties - electrical, optical properties - Environmental Properties, Corrosionproperties - shape and size - Material Cost and Availability– failure analysis.	3
3	**Materials Selection Charts and Testing** Ashby material selection charts-Testing of Metallic Materials - Selection of Materials for Biomedical Applications - Medical Products - Materials in Electronic Packaging - Advanced Materials in Sports Equipment - Materials Selection for Wear Resistance - Advanced Materials in Telecommunications - Using Composites - Manufacture and Assembly with Plastics, fiber and Diamond Films	6
4	**Mechanical Testing** Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.	6
5	**Non Destructive Testing** Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles, Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test,Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.	6
6	**Material Characterization Testing** Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.	6
7	**Other Testing** Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermomechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X- Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.	4

Course Outcomes:

CO1: To understand importance of engineering materials.

CO2: To choose materials for engineering applications.

CO3: To identify the material properties.

CO4: To identify suitable testing technique to inspect industrial component.

CO5: To use different techniques and know its applications and limitations.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1	:	Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.
PSO 2	:	Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.
PSO 3	:	Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	2	3	2	3	-	-	-	3	3	2	3	3
CO2	3	3	3	2	3	2	3	-	-	-	3	3	2	3	3
CO3	3	3	3	2	3	2	3	-	-	-	3	3	2	3	3
CO4	3	3	3	2	3	2	3	-	-	-	3	3	2	3	3
CO5	3	3	3	2	3	2	3	-	-	-	3	3	2	3	3
Avg	3	3	3	2	3	2	3	-	-	-	3	3	2	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE ME702H**	Category: **Professional Elective Courses**
Subject Name: **Advanced Welding Technology**	Semester: **VII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To impart knowledge about different welding processes and their applicability.To make the students understand the mechanism behind weld joints.
To impart ideas of different testing techniques of the welded joint

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Review of welding processes, joint design.	3
2	Descriptions and Parametric influences on Welding processes: Arc Welding- SMAW, Stud Arc welding, SAW, GMAW, GMAW-P,FCAW, GTAW, GTAW-P. Resistance Welding processes- Spot, Butt, Seam, Projection. Solid State Welding processes- Forge welding, Friction welding, Friction Stir welding, Diffusion welding, Roll welding.	6
3	Arc Welding- Different types of equipment, Power sources, Choiceof Polarity, Arc characteristics, Modes of Metal Transfer, Welding Positions, Electrode selection.	5
4	Critical and Precision Welding processes- USW, PAW, LBW, EBW. Underwater Welding- Wet Welding and Dry Welding: Hyperbaric and Cavity. Welding of Plastics- Hot Gas Welding, Hot Tool Welding, Hot Press Welding, Friction Welding, Ultrasonic Welding. Joining of Ceramics and Composites.	8
5	Welding Metallurgy, HAZ, Effect of different process parameters onthe characteristics of weldment. Weldability of Plain Carbon Steel, Stainless Steel, Cast Iron, Aluminium and its Alloys.	8
6	Welding Defects- Types, Causes, Inspection and Remedial Measures.Testing of Welded Joints- Visual Inspection, Dye-Penetration (DP) Test, Ultrasonic Test and Radiography Test.	3
7	Welding Fixtures, Welding Automation and Robotic Welding. Safe Practices in Welding.	3

Course Outcomes:

CO1: To familiarize different types of welding processes.
CO2: To familiarize the basic mechanism behind weld joint and influencing factors.
CO3: To impart the knowledge different tests to judge soundness of the weld joint.
CO4: To understand the limitations of welding.
CO5: To understand different position of welding.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods

including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	2	1	2	2	1	1	-	-	-	-	2	2	1	1
CO2	2	3	3	3	3	2	2	-	-	-	-	2	2	2	2
CO3	3	2	2	2	3	2	2	-	-	-	-	3	2	2	2
CO4	3	3	2	2	3	2	2	-	-	-	-	3	2	1	2
CO5	3	3	2	3	3	3	2	-	-	-	-	3	3	2	3
Avg	2.6	2.6	2	2.4	2.8	2	1.8	-	-	-	-	2.6	2.2	1.6	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **OE ME701D**	Category: **Open Elective Courses**
Subject Name: **Non-Conventional Energy Sources**	Semester: **VII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To have an idea about different sources of renewable energy that would be sustainable. To have the concept of using solar energy for heating as well as Photovoltaic Generation.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Principles of Renewable Energy: The history of energy scene, energy of the future: sustainable energy, development and role of renewableenergy, Scientific Principles of renewable energy.	4
2	Review of principles of thermodynamics, fluid dynamics and heat transfer.	1
3	Solar Radiation: i) Sun-Earth geometry, ii) Extraterrestrial Solar Radiation, iv) Measurement and estimation of solar radiation.	4
4	Solar Water Heating: i) Flat Plate Collectors: Heat Transfer analysis, Testing ii) Evacuated Tube Collectors	5
5	Other Solar Thermal Applications: i) Air heaters, ii) WaterDesalination, iii) Space Cooling, iv) Solar Concentrators, v) Solar ponds	3
6	Photovoltaic Generation: i) Photon absorption at Silicon p-n junction, ii) Solar Cell, iii) Application and Systems.	4
7	Wind Power: i) Turbine types & terms, ii) Mechanical & Electrical Power from Wind Turbines.	3
8	Biomass & Biofuels: i) Use of Biomass, ii) Classification & Use of Biofuels.	3
9	Wave Power & Tidal Power: Basic Concepts	3
10	Ocean Thermal Energy Conversion, Geothermal Energy. Energy Storage	6

Course Outcomes:

After completing this course, the students will

CO1: Know about the energy scenario at present and the need of using renewable energy for sustainability.

CO2: Know specifically the use of solar energy for heating as well as photovoltaic generation

CO3: Be able to understand various other types of Energy sources like Biomass, Geothermal Energy, Wind Energy, Tidal Energy, OTEC etc.

CO4: Be able to understand which type of Renewable Energy Plant will be constructed at a given location.

CO5: Be able to explore society's present needs and future energy demands

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	3	3	3	3	3	3	2	1	2	2	3	3	3	3
CO2	3	2	2	3	-	2	3	-	-	-	1	3	3	2	3
CO3	3	3	3	3	3	-	3	-	2	2	2	3	3	3	3
CO4	3	3	3	3	3	3	3	2	2	2	2	3	3	3	3
CO5	3	3	3	3	3	3	3	2	-	-	3	3	3	3	3
Avg	2.8	2.8	2.8	3	3	2.8	3	2	1.66	2	2	3	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **HM-HU701**	Category: **Humanities and Social Sciences including Management Courses**
Subject Name: **Economics for Engineers**	Semester: **VII**
L-T-P: **2-0-0**	Credit: **2**

Course Objectives:

1. To make general awareness among budding engineers regarding basic principles of economicsand that needed to use in an industry.
2. To give basic understanding of engineering costs, estimation, depreciation analysis and basic accounting principles.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Economic Decisions Making- Overview, Problems, Role, Decision making process.	2
2	Engineering Costs & Estimation- Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring and Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types of Estimate, Estimating Models - Per- Unit Model, Segmenting Model, Cost Indexes, Power- Sizing Model, Improvement & Learning Curve, Benefits.	4
3	Present Worth Analysis: End-of-Year Convention, Viewpoint of Economic Analysis Studies, Borrowed Money Viewpoint, Effect of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.	4
4	Cash Flow & Rate of Return Analysis- Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Break-Even Analysis. Economic Analysis in the Public Sector- Quantifying and Valuing Benefits & drawbacks.	4
5	Depreciation- Basic Aspects, Deterioration & Obsolescence, Depreciation and Expenses, Types of Property, Depreciation Calculation Fundamentals, Depreciation and Capital Allowance Methods, Straight- Line Depreciation Declining Balance Depreciation, Common Elements of Tax Regulations for Depreciation and Capital Allowances.	4
6	Inflation and Price Change- Definition, Effects, Causes, Price Change With Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes in Engineering Economic Analysis, Cash Flows that inflate at different Rates.	3
7	Accounting- Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	3

Course Outcomes:

Student will be able

CO1: To understand Economic Decisions Making criteria

CO2: To know basic principles of engineering costs, estimation and depreciation analysis.

CO3: To understand basic accounting principles.

CO4: Understand the impact of inflation, taxation, depreciation. Financial planning, economic basis for replacement, project scheduling, and legal and regulatory issues are introduced and applied to economic investment and project-management problems.

CO5: Develop and analyze information on investment planning and cost controls, and conduct cost/benefit analysis.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

CO-PO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
CO1	3	3	3	3	3	3	-	-	-	-	-	3
CO2	3	3	3	3	3	2	-	-	-	-	-	3
CO3	3	3	3	3	3	3	-	-	-	-	-	3
CO4	3	3	3	3	3	3	-	-	-	-	-	3
CO5	3	3	3	3	2	2	-	-	-	-	-	3
Avg	3	3	3	3	2.8	2.6	-	-	-	-	-	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PC-ME791**	Category: **Professional Core courses**
Subject Name: **Mechanical Engineering Laboratory III (Manufacturing)**	Semester: **VII**
L-T-P: **0-0-3**	Credit: **1.5**

Course Objectives:

Students will gain a practical knowledge of various manufacturing processes in a hands-on environment through experiments and simulations.

Course Content:

Module No	Description of Topic
1	Measurement of Cutting Force in Turning
2	Study of the effect of parametric variation in arc welding
3	Testing of moulding sand
4	Testing for Weld Quality
5	Study of and Solving problems on geometry of robot manipulator, actuators and grippers
6	Programming on CNC Lathe using G and M Codes
7	Programming on CNC Lathe using APT
8	Programming on CNC Milling Machine using G and M Codes
9	Programming on CNC Milling Machine using APT
10	Programming on CNC machine Simulator and to observe virtual machining
11	Robot Programming
12	Experiments on AJM/ USM/ WEDM/ EDM/ ECM/ LBM
13	Design and manufacture of products using Additive Manufacturing

Course Outcomes:

At the end of the course, a student will be able to:

CO1: Study cutting forces in machining processes
CO2: Test the quality of weld and moulding sands
CO3: Develop a practical understanding of advanced manufacturing processes.
CO4: Understand the working of a robot and its programming
CO5: Identify and rectify defects in parts and manufacturing processes related problems.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	2	1	2	2	1	1	-	-	-	-	2	2	1	1
CO2	2	3	3	3	3	2	2	-	-	-	-	2	2	2	2
CO3	3	2	2	2	3	2	2	-	-	-	-	3	2	2	2
CO4	3	3	2	2	3	2	2	-	-	-	-	3	2	1	2
CO5	3	3	2	3	3	3	2	-	-	-	-	3	3	2	3
Avg	2.6	2.6	2	2.4	2.8	2	1.8	-	-	-	-	2.6	2.2	1.6	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PW-ME 781**	Category: **Project**
Subject Name: **Project III**	Semester: **VII**
L-T-P: **0-0-6**	Credit: **3**

Course Objectives:

To develop the ability to identify, formulate and analyze engineering problems through literature survey, recent trends in industries and by applying the knowledge of science and engineering fundamentals.

To train students in preparing project reports, to face reviews and viva voce examination.

Course Content:

It is intended to start the project work early in the seventh semester and carry out both design and fabrication of a mechanical device whose working can be demonstrated. The design and formulation of the problem is expected to be completed in the seventh semester and the fabrication and demonstration will be carried out in the eighth semester. The students in a group of 4 to 6 works on a topic are to be approved by the head of the department under the guidance of a faculty member. The students prepare a comprehensive project report after completing the work to the satisfaction of the supervisor to be submitted at the end of the semester. The progress of the project is evaluated by a committee may be constituted by the Head of the Department. The project work is evaluated based on oral presentation and the project report may jointly by external and Internal examiners constituted by the Head of the Department.

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Formulate a practical or design problem and explore its possible solution after suitable review of literature.

CO2: Analyse the given problem and find the safest suitable solution on the basis of engineering knowledge.

CO3: Evaluate the outcome of the problem and validate findings on the basis of experimentation/analysis.

CO4: Produce the content in the form of report as per the standard scientific norms.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	3	-	1	1	-	2	-	-	2	3	2	-
CO2	3	3	3	3	2	2	2	-	2	-	-	2	3	3	1
CO3	3	3	2	3	3	-	-	2	-	-	1	2	2	-	-
CO4	-	-	-	1	-	-	-	2	2	3	2	2	-	-	-
Avg	3	3	2.67	2.5	2.5	1.5	1.5	2	2	3	1.5	2.	2.67	2.5	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE ME801B**	Category: **Professional Elective Courses**
Subject Name: **Power Plant Engineering**	Semester: **VIII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To familiarize students with different aspects of power plant engineering, working of power plants based on different fuels and to expose the students to the principles of safety and environmental issues.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Analysis of Steam Cycles:** Introduction to the course, Power plant layout and essential feature of Rankine cycle, Reheating and regeneration, Problems on RankineCycle, Combined cycle power generation, Binary vapour cycles.	3
2	**Boilers:** Definition, classification, fire tube and water tube boilers, mountings and accessories. Draft in boilers, performance of boiler – boilers efficiency, equivalent evaporation, Losses in boilers. Coal and combustion: Properties of coal, ultimate analysis and proximate analysis, combination calculation. Super heater, economizer and air- pre heater. Handling of coal and ash.	8
3	Fuel bed firing, PF firing and Fluidized bed boilers. Introduction toboiling and circulation in boilers. Power station boilers – Benson, Lamont. Supercritical boiler.	4
4	**Steam turbine:** parts and classification, ii) nozzles types, flow through nozzles and nozzle efficiency. Impulse turbine – velocity diagram, work done andblade efficiency.	6
5	**Turbines:** Pressure compounding and velocity compounding of steam turbine. Impulse reaction turbine – Velocity diagram, degree of reaction andParsons turbine. Governing in Steam turbine.	6
6	**Condensers:** Direct Contact Condenser Surface Condensers, Effect of various parameters on condenser performance, Design of condensers,cooling towers and cooling ponds.	6
7	**Power plant economics and other issues:** Load duration curves, Power plant economics, estimation of tariff. Diesel and gas plants, Pollution and control, Greenhouse effect and control, Peak load plants.	3

Course Outcomes:

At the end of the course, student will be able to

CO1: Understand functions of the various components of power plant.

CO2: Illustrate the working of nuclear, thermal and gas-based power plants.

CO3: Evaluate the design layout and working of hydroelectric power plants.

CO4: Estimate the feasibility and its implications on power generating units.

CO5: Evaluate and design an independent power plant based on advanced Rankine cycle.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design

system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	3	3	2	2	-	2	2	2	3	3	3	3
CO2	3	3	3	3	3	2	2	-	2	2	2	3	3	3	3
CO3	3	3	3	3	3	2	2	-	2	2	2	3	3	3	3
CO4	3	3	3	3	3	2	2	-	2	2	2	3	3	3	3
CO5	3	3	3	3	3	2	2	-	2	2	2	3	3	3	3
Avg	3	3	3	3	3	2	2	-	2	2	2	3	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE ME802F**	Category: **Professional Elective Courses**
Subject Name: **3D Printing and Design**	Semester: **VIII**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

The course is designed to impart knowledge and skills related to 3D printing technologies, selection of material and equipment and develop a product using this technique in Industry4.0 environment.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**3D Printing (Additive Manufacturing):** Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications.	2
2	**CAD for Additive Manufacturing**: CAD Data formats, Data translation, Data loss, STL format.	3
3	**Additive Manufacturing Techniques:** 3.1 Stereo-Lithography, LOM, FDM, SLS, SLM, Binder Jettechnology. 3.2 Process, Process parameter, Process Selection for variousapplications. 3.3 Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools	10
4	**Materials:** 4.1 Polymers, Metals, Non-Metals, Ceramics 4.2 Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. 4.3 Support Materials	
5	**Additive Manufacturing Equipment:** 5.1 Process Equipment- Design and process parameters 5.2 Governing Bonding Mechanism 5.3 Common faults and troubleshooting 5.4 Process Design	8
6	**Post Processing:** Requirement and Techniques	3
7	**Product Quality:** 7.1 Inspection and testing 7.2 Defects and their causes	3

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop CAD models for 3D printing, import and export CAD data to generate .stl file.
CO2: Select a specific material for the given application.
CO3: Select a 3D printing process for an application.
CO4: Produce a product using 3D Printing or Additive Manufacturing.
CO5: Understand the utility of this technology in modern healthcare.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	2	3	2	2	2	1	1	-	-	-	-	2	2	1	2
CO2	3	3	3	3	3	2	2	-	-	-	-	3	2	2	2
CO3	3	2	2	3	2	2	2	-	-	-	-	3	2	2	2
CO4	3	3	2	2	3	2	2	-	-	-	-	3	2	1	2
CO5	3	3	2	3	3	3	2	-	-	-	-	3	3	3	3
Avg	2.8	2.8	2.2	2.6	2.6	2	1.8	-	-	-	-	2.8	2.2	1.8	2.2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PE ME802I**	Category: **Professional Elective Courses**
Subject Name: **Maintenance Engineering**	Semester: **VIII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To provide knowledge on different aspects of repair and maintenance practised in industry.
To make students familiar with different repair and maintenance strategies used in industry.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction:** Definitions of repair and maintenance; Importanceof maintenance; Different maintenance systems- breakdown, preventive, planned; predictive maintenance through condition monitoring; Maintainability, failure pattern, availability of equipment/ systems, design for maintainability.	5
2	**Total Productive Maintenance (TPM):** definition, objective & methodology; Implementation of TPM; Lean maintenance; Overall equipment effectiveness (OEE).	3
3	**Organizational structures for maintenance:** Objective; Maintenance functions and activities; Organizational requirements; Types of maintenance organizations, Manpower planning; Engineering stores & inventory management.	4
4	**Economic Aspect of Maintenance:** Life cycle costing; Maintenance cost & its impact; Maintenance budget; Cost control;Maintenance audit- Procedure, tools, planning, reports.	4
5	**Function and use of Maintenance Equipment, Instruments & Tools:** Facilities like NDT, painting, coating and cladding, Gascutting and welding, crack detection, vibration monitor, balancing equipment, compressor, basic machine tools, lubricators and lubricants, chain pulley block, Tools like different types ofwrenches, torque wrench, pipe wrench, plier, screw driver, dimension measuring instruments, feeler gauge, scraper, fitting shop tools, spirit level, hand grinder & drill, screw jack, etc.	6
6	**Lubrication:** Purpose & importance; Type of lubricants,Properties of lubricants; Types of lubrication and their typical applications, lubrication devices, centralized lubrication system; Gasket, packing and seals.	4
7	**Repair & Maintenance Procedures:** Repair of cracks, threads, worn shafts, keyways, bush bearing, damaged gear tooth. Assembly and dismantling of antifriction bearing; Maintenance of bearing, clutches, coupling, brakes, Alignment of shafts, belt and chain drives, gear drives, centrifugal pump, pipe and pipe fittings, electrical wiring, isolators and main switches, small induction motors; Steps for installation of a machine.	10

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Know different types of repair and maintenance procedures practiced in industry.
CO2: Understand various condition monitoring techniques.
CO3: Understand different repair and maintenance strategies used in industry.
CO4: Understand the organizational structure of an industry for maintenance management and the economy involved in this.
CO5: Understand the repair methods of material handling equipment.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

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PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	2	2	1	-	1	-	-	-	-	-	1	3	3	3
CO2	3	2	2	1	-	1	-	-	-	-	-	1	3	3	3
CO3	2	2	2	1	-	1	-	-	-	-	-	1	3	3	3
CO4	2	2	2	1	-	1	-	-	-	-	-	1	3	3	3
CO5	3	2	2	1	-	1	-	-	-	-	-	1	3	3	3
Avg	2.6	2	2	1	-	1	-	-	-	-	-	1	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **OE ME801C**	Category: **Open Elective Courses**
Subject Name: **Safety and Occupational Health**	Semester: **VIII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To express knowledge about various aspects of industrial safety and occupational health. To understand causalities of an accident and steps for their prevention.
To aware about health and safety management and related legislation.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Development of industrial safety. Developments in Occupational Health, Occupational Safety and Health in India.	2
2	Accidents and their prevention, Theory of accident, Anatomy of an accident, Causalities of an accidents. Cost of accidents, Principles of accident prevention, Techniques of accident prevention, Safe work environment, Housekeeping, Job safety analysis, Investigation of accidents, Ergonomics, Personal protective equipment, Promotion of health and safety, Basic safety programming.	6
3	Fire hazard- Types of fire, Fire hazards, Fire explosion, fire prevention, Means of escape in case of fire inspection safety, Supervision safety, Responsibility safety inspection, Fire preventionauthorities, Rules safety training safety, Appraisal safety communication, Safety audit.	6
4	Occupational health and safety- Occupational Health, Occupationalhealth services in places of employment, Occupational physician, Occupational health in developing countries, Occupational safety, Occupational safety in developing countries, Promoting occupational health and safety, Work related diseases, Occupational health hazards, Recognition of hazards, Industrial hygiene, Occupational diseases, Basics of OHSAS 18001.	6
5	Health and safety at workplaces- Health and Safety hazards, Occupational health requirements, Occupational safety requirements, Occupational welfare requirements, Abstracts and Notices, Obligations of a worker, Obligations of occupier, Personal protective equipment, Causes of accidents, Prevention of accidents, Safety Legislation, Safety Guidelines, emergency actions, related acts (related to chemical processes, mines, workshop practices, construction work, electrical installations)	6
6	Health and safety management- Basics of Safety management, Role of safety supervisor, Planning for safety, Safety Policies, Safety Promotion, Safety Committee, Safety education & training, Health and Safety Process, Measuring Safety, Risk Management, Loss Control.	4
7	Accident Compensation- Brief introduction to different acts- The Dangerous Machines (Regulations) Act, 1983, The Employers' Liability Act, 1938 The (Indian), Fatal Accidents Act, 1855, The Public Liability Insurance Act, 1991, The Workmen's Compensation Act, 1923, The Employees' State Insurance Act, 1948, Role of National Safety Council, International labour office.	6

Course Outcomes:

By the end of this course, a student should:

- CO1: Evaluate workplace to determine the existence of occupational safety and health hazards
- CO2: Identify relevant regulatory and national consensus standards along with best practices that are applicable.
- CO3: Select appropriate control methodologies based on the hierarchy of controls
- CO4: Analyze injury and illness data for trends.
- CO5: Understand the different labour law and company acts.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

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PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	1	-	-	-	-	3	3	2	-	1	-	-	3	-	-
CO2	-	-	-	-	-	3	3	2	-	2	-	2	3	-	-
CO3	1	-	-	-	-	3	3	1	-	2	2	-	3	-	-
CO4	2	-	-	-	-	3	3	1	-	2	1	-	3	-	-
CO5	-	-	-	-	-	3	3	2	-	2	2	2	3	-	-
Avg	1.33	-	-	-	-	3	3	1.6	-	1.8	1.66	2	3	-	-

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **OE ME802E**	Category: **Open Elective Courses**
Subject Name: **Energy Conservation and Management**	Semester: **VIII**
L-T-P: **3-0-0**	Credit: **3**

Course Objectives:

To understand the energy data from industries and carry out energy audit for energy savings.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to energy & power scenario of world, National Energy consumption data, environmental aspects associated with energy utilization; Energy Auditing- need, types, methodology and barriers, role of energy managers, instruments of energy auditing.	9
2	Components of EB billing, HT and LT supply, transformers, cable sizing; Concept of capacitors, power factor improvement, harmonics; Electric motors- motor efficiency computation, energy efficient motors; Illumination- Lux, Lumens, types of lighting, efficacy, LED lighting and scope of energy conservation in lighting.	9
3	Thermal systems, Boilers, Furnaces and Thermic Fluid heaters- efficiency computation and energy conservation measures; Steam distribution and usage, steam traps, condensate recovery, flash steam utilization; Insulation & Refractories.	9
4	Energy conservation in major utilities; pumps, fans, blowers, compressed air systems, Refrigeration& Air Conditioning systems, Cooling Towers, DG sets. Energy Economics- discount period, payback period, internal rate of return, net present value; Life Cycle costing- ESCO concept.	9

Course Outcomes:

Upon completion of this course, the students will be able to

CO1: Understand principles of energy management and its influence on environment.

CO2: Comprehend methods of energy production for improved utilization.

CO3: Improve the performance of thermal systems using of energy management principles

CO4: Analyze the methods of energy conservation for air conditioning, heat recovery and thermalenergy storage systems.

CO5: Prepare energy audit report of energy consumption for industries

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

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PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	3	3	3	3	2	2	2	2	2	2	2	3
CO2	2	2	2	2	2	1	3	2	-	2	3	3	2	2	2
CO3	3	3	3	3	3	3	3	-	-	-	-	3	3	3	3
CO4	3	3	3	3	3	3	3	-	-	-	-	3	3	3	3
CO5	2	2	2	2	2	2	3	3	3	3	3	2	2	2	2
Avg	2.6	2.6	2.6	2.6	2.6	2.4	3	2.33	2.5	2.3	2.6	2.6	2.4	2.4	2.6

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PW-ME 881**	Category: **Project**
Subject Name: **Project IV**	Semester: **VIII**
L-T-P: **0-0-10**	Credit: **5**

Course Objectives:

To develop the ability to conduct investigations of complex engineering problems using research knowledge, methods and other modern engineering tools.

To train the students in preparing project reports, to face review and viva voce examination.

Course Content:

It is intended to start the project work early in the seventh semester and carry out both design and fabrication of a mechanical device whose working can be demonstrated. The design and formulation of the problem is expected to be completed in the seventh semester and the fabrication and demonstration will be carried out in the eighth semester. The students in a group of 4 to 6 works on a topic are to be approved by the head of the department under the guidance of a faculty member. The students prepare a comprehensive project report after completing the work to the satisfaction of the supervisor to be submitted at the end of the semester. The progress of the project is evaluated by a committee may be constituted by the Head of the Department. The project work is evaluated based on oral presentation and the project report may jointly by external and Internal examiners constituted by the Head of the Department.

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Formulate a practical or design problem and explore its possible solution after suitable review of literature.

CO2: Analysis the given problem and find the safest suitable solution on the basis of engineering knowledge.

CO3: Evaluate the outcome of the problem and validate findings on the basis of experimentation/analysis.

CO4: Produce the content in the form of report as per the standard scientific norms.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

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CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	3	3	3	3	-	1	1	-	2	-	-	2	3	2	-
CO2	3	3	3	3	2	2	2	-	2	-	-	2	3	3	1
CO3	3	3	2	3	3	-	-	2	-	-	1	2	2	-	-
CO4	-	-	-	1	-	-	-	2	2	3	2	2	-	-	-
Avg	3	3	2.67	2.5	2.5	1.5	1.5	2	2	3	1.5	2	2.67	2.5	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions
Department of Mechanical Engineering

Subject Code: **PW-ME 882**	Category: **Professional Core Courses**
Subject Name: **Comprehensive Viva-Voce**	Semester: **VIII**
L-T-P: **0-0-0**	Credit: **1.5**

Course Objectives:

The objective of comprehensive viva-voce is to assess the overall knowledge, a student acquired in the relevant field of engineering over 4 years of study in the programme. In doing so, the main objective is to prepare the students to face interview both in the academic and the industrial sector.

Course Content:

The Comprehensive Viva-Voce will be conducted by a committee consisting of Head of the Department and all Faculty members of the department. The Comprehensive Viva-Voce is intended to assess the student's understanding of the courses he/ she studied during the 4 years B. Tech. programme.

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Prepare for the interview in a better way by brushing up different course papers so that overall knowledge on Mechanical Engineering areas would be sharpened

CO2: Be equipped with analytical and evaluation abilities to respond to impromptu questions at the interviews

CO3: Face interview panels and present the knowledge, skills and problems in the most efficient way.

Program Outcomes:

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an Engineering specialization to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct Investigations of Complex Problems: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering Activities with an understanding of the limitations.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Professional engineering practice

PO7: Environment and Sustainability: Understand the impact of the professional engineering Solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and Management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12: Life-Long Learning: Recognize the need for, and have the preparation and ability to engage in Independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes:

PSO 1 : Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PSO 2 : Exhibit the problem-solving ability and hands-on skills to set foot in careers in the design, manufacturing, testing, installation and maintenance of mechanical systems.

PSO 3 : Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternative and renewable energy resources.

CO-PO & CO-PSO Mapping

	PO1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PSO3*
CO1	-	-	-	-	-	-	-	1	3	3	-	2	-	2	-
CO2	-	-	-	-	-	-	-	1	3	3	-	3	-	2	-
CO3	-	-	-	-	-	-	-	1	3	3	-	2	-	3	-
Avg	-	-	-	-	-	-	-	1	3	3	-	2.33	-	2.33	-

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

---------X---------

Course Code : ES-EE191	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	**Semester** : First
L-T-P : **0-0-2**	**Credit: 1**
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
   (a) Voltmeter
   (b) Ammeter
   (c) Multimeter
   (d) Oscilloscope

   Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronousmachine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change involtage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation ofimpedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
   (b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shiftsbetween the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change ofphase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.

14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter forspeed control of an Induction motor
15. Demonstration of components of LT switchgear.

Course Outcomes

1. To understand basic safety precautions and instructions.
2. To understand the concept of calibration of ammeter and wattmeter, basics of active power and reactive power, balanced, unbalanced system and power measurement.
3. To understand steady state and transient response of R-L, R-C and R-L-C circuit, resonance frequency and quality factor.
4. To study open circuit and short circuit test of a single-phase transformer
5. To study the torque-speed characteristics of separately excited dc motor, induction motor and operating characteristics of synchronous generator.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ES-EE191.CO1	3	3	3	2	3	3	3	2	3	3	-	3	3	3	3
ES-EE191.CO2	3	3	2	2	3	3	2	-	-	-	-	3	2	2	2
ES-EE191.CO3	3	3	3	2	3	3	2	-	-	-	-	3	2	2	2
ES-EE191.CO4	3	3	3	1	3	3	-	-	-	-	-	3	2	2	2
ES-EE191.CO5	3	3	3	1	3	3	-	-	-	-	-	3	2	2	2
Average	3	3	3	1.6	3	3	2.3	2	3	3	-	3	2.2	2.2	2.2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering systems or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties.

Course Code : ES-EE101	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering	**Semester** : First
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Course Outcomes

1. To understand and analyze DC circuits and relevant theorems.
2. To understand different AC network theorems, circuits and tools for solution of networks.
3. To study the working principles of power converters.
4. To introduce the components of low voltage electrical installations.
5. To understand basic concepts, construction, working principle and fundamentals of Electric Machines.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ES-EE101.CO1	3	3	3	2	3	3	1	-	-	-	-	3	1	2	2
ES-EE101.CO2	3	3	3	2	3	3	1	-	-	-	-	3	1	2	2
ES-EE101.CO3	3	3	3	2	3	3	2	-	-	-	-	3	2	2	2
ES-EE101.CO4	3	3	3	1	3	3	2	-	-	-	-	3	2	2	2
ES-EE101.CO5	3	3	3	1	3	3	2	-	-	-	-	3	2	2	2
Average	3	3	3	1.6	3	3	1.6	-	-	-	-	3	1.6	2	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering systems or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties.

OmDayal Group of Institutions

Department of Department of Basic Science and Humanities

Course Code : BS-PH191/ BS-PH291	**Category :** Basic Science course
Course Title : Physics-I Laboratory	**Semester** : First/ Second
L-T-P : **0-0-3**	**Credit:1.5**

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and sheer force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

Course Outcomes:

1. Analyses the physical properties of Light as well as the phenomenon of Dispersion to perceive concepts of modern optics.

2. Determine electrical and magnetic properties.
3. Measure some quantum mechanical constants.

4. Analyses the different parameter related to general properties of matter.
5. Determine the elastics and viscous properties.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSPH191.CO1	3	3	3	3	2	1	_	_	3	_	_	3
BSPH191.CO2	3	3	3	3	3	1	_	_	3	_	_	3
BSPH191.CO3	3	2	3	3	3	1	_	_	3	_	_	3
BSPH191.CO4	3	3	3	3	2	_	_	_	3	_	_	3
BSPH191.CO5	3	3	3	3	2	1	_	_	3	_	_	3
Average	3	2.8	3	3	2.4	1	_	_	3	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Basic Science and Humanities

Subject Code: **BS-PH101**	Category: **Basic Science Courses**
Subject Name: **Physics-I**	Semester: **First**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

To motivate or challenge students to understand basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Mechanics:** Problems including constraints & friction. Basic ideas of vector calculus and partial Differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.	7
2	**Optics:** Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications. Polarisation: Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity. Lasers: Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples.	5
3	**Electromagnetism and Dielectric Magnetic Properties of Materials:** Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation(expression only), applications of dielectrics. Magnetisation , permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.	8
4	**Quantum Mechanics:** Introduction to quantum physics, black body radiation, explanation	16

	using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.	
5	**Statistical Mechanics:** Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.	8

Course Outcomes:

1. Upon completion of this course, students will be able to understand the Basic concepts of mechanics, effect of various types of forces on a body, causes and effects of vibration.
2. Students will be able to interpret the intensity variation of light due to Polarization, interference and diffraction, transverse nature of Light-Polarization, Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
3. Upon completion of this course, students will be able to understand the magnetic and dielectric properties of various material and also properties of materials such as, permeability, polarization, etc .
4. Students will be familiar with some of the basic laws related to quantum mechanics as well as simple quantum mechanics calculations.
5. Upon completion of this course, students will be able to understand the application of statistical Mechanics in case of Engineering Thermodynamics.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSPH101.CO1	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO2	3	3	3	3	3	2	_	_	_	_	_	3
BSPH101.CO3	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO4	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO5	3	3	3	3	2	2	_	_	_	_	_	3
Average	3	3	3	3	2.8	2.6	_	_	_	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: BS-M102	Category: Basic Science Course
Subject Name: Mathematics – IB	Semester: **I**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

To motivate students to understand the basic concepts calculus differentiation and integration, evolutes, sequence and series, eigen values, limit, continuity of several variables and study the different types matrices.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Calculus (Integration):** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	**Calculus (Diferentiation):** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	**Sequence and Series:** Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem	11
4	**Multivariate Calculus:** Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	**Matrices:** Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course the student will be able to

1.Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

2.Understand the domain of applications of mean value theorems to engineering problems.

3. Learn the tools of power series and Fourier series to analyse engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines

4.Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

5.Understand the different types of matrices, concept of rank, methods of matrix inversion and their applications.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSM102.CO1	2	3	3	3	_	_	_	_	_	_	_	3
BSM102.CO2	3	3	1	2	_	_	_	_	_	_	_	3
BSM102.CO3	3	3	3	3	_	_	_	_	_	_	_	3
BSM102.CO4	3	3	2	3	_	1	_	_	_	_	_	3
BSM102.CO5	2	3	2	2	_	_	_	_	_	_	_	3
Average	2.6	3	2.2	2.6	_	1	_	_	_	_	_	3

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: ES-ME 291	Category: Engineering Science Courses
Subject Name: Engineering Graphics & Design	Semester:2nd
L-T-P: 1-0-4	Credit: 3
Prerequisite:	

Course Objective

Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Course Syllabus

Module No.	Content	Lecture (L)	Practical (P)
1	**INTRODUCTION TO ENGINEERING DRAWING** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	**LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales.	1	4
3	**GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral.	1	4
4	**PROJECTION OF POINTS, LINES, SURFACES** Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	**PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	**COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	**ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa,	1	4

	Conventions;		
8	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	**OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION& CAD DRAWING** listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	1	4
10	**ANNOTATIONS, LAYERING & OTHER FUNCTIONS** applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8
11	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid- modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing	2	8

	practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).		

Course Outcome:

ES-ME 291.1: Introduction to engineering design and its place in society
ES-ME 291.2: Exposure to the visual aspects of engineering design
ES-ME 291.3: Exposure to engineering graphics standards
ES-ME 291.4: Exposure to solid modeling
ES-ME 291.5: Introduction to AutoCAD

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:
PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools
PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements
PSO3: To manifest professional and ethical responsibilities while discharging duties

CO-PO Mapping:

Program outcomes/ PSO → / **Course ↓ outcome**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ES-ME 291.1	1	-	-	-	-	1	-	-	-	1	-	2	3	3	3
ES-ME 291.2	3	2	2	1	-	-	-	-	2	1	-	-	3	3	3
ES-ME 291.3	3	2	2	-	-	-	-	-	-	1	-	2	3	3	3
ES-ME 291.4	3	2	2	-	-	-	-	-	2	1	-	2	3	3	3
ES-ME 291.5	3	2	2	-	3	-	-	-	2	1	-	2	3	3	3
Average	2.6	2	2	1	3	1	-	-	2	1	-	2	3	3	3

Note:

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions

Department of Chemistry

Course Code : BS-CH201	**Category :** Basic Science Courses
Course Title : Chemistry-I	**Semester** : Second
L-T-P : **3-1-0**	**Credit:4**

Course Objectives:

To motivate students to understand the basic concepts of atomic and molecular structure, spectroscopic techniques and applications, free energy and equilibrium, periodic properties of elements and stereochemistry and structures of compounds and study the different types of organic reactions

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Atomic and molecular structure:** Schrodinger equation. Particle in box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H_2). Energy level diagrams of diatomic. Pi-molecular orbital of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.	10
2	**Spectroscopic techniques and applications** Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering	8
3	**Intermolecular forces and potential energy surfaces** Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena	4
4	**Use of free energy in chemical equilibria** First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.	8
5	**Periodic properties** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries	4
6	**Stereochemistry** Representations of 3 dimensional structures, structural isomers and	4

	stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds	
7	**Organic reactions and synthesis of a drug molecule** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.	4

Course Outcomes:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energylevels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electro negativity, oxidation states andelectro negativity.
5. List major chemical reactions that are used in the synthesis of molecules.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BS-CH201.CO1	2	2					2					2
BS-CH201.CO2	2	2	2				2					2
BS-CH201.CO3	2	2	2		2		2					2
BS-CH201.CO4	2	2					2					2
BS-CH201.CO5	2	2	2		2							2
Average	2	2	2		2		2					2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Department of Chemistry

Course Code : BS-CH291	**Category :** Basic Science Courses
Course Title : Chemistry-I Laboratory	**Semester** : 2nd
L-T-P : **0-0-3**	**Credit:1.5**

Course Objectives:
To motivate students to understand the basic concepts of conductance, pH, electrochemical cells and its applications, measure Chloride ion and Dissolved Oxygen in given water sample, separation of mixtures, and study viscosity and partition coefficient.

Course Content:

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromateindicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part

Course Outcomes:

1. Estimate the concentration of acid/alkali, cell constant by conductometric/ pH metric method using electrochemical cells.
2. Analyze different components from their mixtures by adsorption and TLC method.
3. Calculate the composition of given solution using Oswald Viscometer.
4. Determine rate constant for hydrolysis of ester by acid catalyzed and distribution coefficient of acetic acid between n-butanol and water
5. Determine the amount of chloride and dissolved oxygen present in a given water sample

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BS-CH191.CO1	2	2	2	-	2	2	2	-	-	-	-	2
BS-CH191.CO2	2	2	2	-	2	2	-	-	-	-	-	2
BS-CH191.CO3	-	-	2	-	-	2	-	-	-	-	-	2
BS-CH191.CO4	-	-	2	-	-	2	-	-	-	-	-	2
BS-CH191.CO5	-	2	2	-	-	2	2	-	-	-	-	2
Average	2	2	2		2	2	2	-	-	-	-	2

PO1: Engineering Knowledge
PO2: Problem Analysis
PO3: Design/Development of Solutions
PO4: Conduct Investigations of Complex Problems
PO5: Modern Tool Usage
PO6: The Engineer and Society
PO7: Environment and Sustainability
PO8: Ethics
PO9: Individual and Team Work
PO10: Communication
PO11: Project Management and Finance
PO12: Life-long Learning

OmDayal Group of Institutions

Department of English

Course Code : HM HU 201	**Category :** Humanities and social sciences including Management Courses
Course Title : English	**Semester** : Second
L-T-P : **2-0-0**	**Credit:2**

COURSE OBJECTIVE :

To help students develop basic proficiency in English Grammar, Vocabulary and Composition, and writing skills.
To help students identify common errors in writing and gain editing skills in the process.
To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs and emails.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	1. Vocabulary Building 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending. 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms	8
2	2. Basic Writing Skills 2.1 Sentence Structures & Types: Simple, Compound, Complex 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration 2.3 Importance of proper punctuation 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order 2.5 Creating Cohesion: Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely	10
3	**3.** Identifying Common Errors in Writing 3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés	8
4	4. Nature and Style of sensible Writing 4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion	10
5	5. Writing Practices 5.1 Comprehension 5.2 Précis Writing	8

	5.3 Essay Writing 5.4 Business Letter, Cover Letter & CV; E-mail	

Course Outcome:

The student will acquire basic proficiency in English including reading and listening comprehension.

The student will acquire basic proficiency in English grammar and vocabulary.

The student will acquire basic proficiency in writing basic technical documents such as business letters, cover letters, CV and emails.

The student will acquire basic proficiency in understanding the nature and style of proper writing.

The student will learn to identify and edit common writing errors.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HMHU201.CO1	-	2	-	2	-	1	-	2	1	3	1	3
HMHU201.CO2	-	-	1	1	-	1	-	2	-	3	-	3
HMHU201.CO3	-	2	2	2	-	2	1	3	3	3	2	3
HMHU201.CO.4	-	2	1	-	-	-	1	3	2	3	-	3
HMHU201.CO.5	-	1	1	1	-	1	1	3	1	3	1	3
Aver	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

age:												

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Computer Science and Engineering

Subject Code: ES-CS201	*Category:* Engineering Science Courses
Subject Name: Programming for Problem Solving	*Semester:* ***II***
L-T-P: : 3-0-0	*Credit:**3***

PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: To learn the concepts and methodologies of computer systems.
PSO2: To gain the knowledge of software development life cycles.
PSO3: To learn the concepts of recent developments in computer technologies.
PSO4: To apply the above knowledge in real life applications.

Course Name: Programming for problem solving (ES-CS201):

Course Outcomes:

ES-CS201.1: To formulate simple algorithms for arithmetic and logical problems.To translate the Algorithms to programs (in C language).
ES-CS201.2: To test and execute the programs and correct syntax and logical errors.To implement Conditional branching, iteration, and recursion
ES-CS201.3: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
ES-CS201.4: To use arrays, pointers, and structures to formulate algorithms and programs.
ES-CS201.5: To apply programming to solve matrix addition and multiplication problems and searching,sorting problems. To apply programming to solve simple numerical method problems, namely rot finding offunction, differentiation of function and simple integration.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-CS201.1	2	3	1	1	1	1	2	3	-	2	3	1	2	2	1	-
ES-CS201.2	3	1	2	1	2	1	-	-	3	2	2	2	3	2	3	1
ES-CS201.3	2	3	2	2	2	-	2	3	3	2	3	2	2	-	3	3
ES-CS201.4	2	3	3	2	-	2	1	2	2	3	1	-	2	3	2	2
ES-CS201.3	3	3	2	2	2	2	1	-	3	3	2	3	3	3	2	1
Average	2.4	2.6	2	1.6	1.4	1.2	1.2	1.6	2.2	2.4	2.2	1.6	2.4	2.0	2.2	1.4

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put“-”

Subject Code: ES-CS291	*Category:* Engineering Science Courses
Subject Name: Programming for Problem Solving Lab	*Semester:* ***II***
L-T-P: : 3-0-0	*Credit:**3***

Course Objectives:

Learn preprogramming steps like writing algorithms, drawing flowcharts. Understand the structure,and learn the syntax and semantics of C programming .variable declaration with different data types and using operators. Concept of different control structures like decision control, loop control and special the concepts and advantages of using functions.¬ Understand the limitations of basic data types and concepts of derived. data types and user defined data types. Learn how to perform various FILE I/O.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	**Introduction to Programming** : Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) . Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory	*4*
2	Arithmetic expressions and precedence.	*2*
3	**Conditional Branching and Loops**: Writing and evaluation of conditionals and consequent branching . Iteration and loops	*6*
4	Arrays : Arrays (1-D, 2-D), Character arrays and Strings	*6*
5	Basic Algorithms : Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)	*6*
6	Function : Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference	*5*
7	Recursion : Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	*5*

8	Structure :Structures, Defining structures and Array of Structures	*4*
9	Pointers : Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list(no implementation)	*2*
10	File handling	*2*

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: To learn the concepts and methodologies of computer systems.
PSO2: To gain the knowledge of software development life cycles.
PSO3: To learn the concepts of recent developments in computer technologies.
PSO4: To apply the above knowledge in real life applications.

Course Name: Programming for problem solving (ES-CS201):

Course Outcomes:

Course Name: Programming for problem solving (ES-CS291):

ES-CS291.1: To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).

ES ES-CS291.2: To test and execute the programs and correct syntax and logical errors. To implement conditional branching, iteration and recursion.

ES-CS291.3:To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

ES-CS291.4: To use arrays, pointers and structures to formulate algorithms and programs. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

ES-CS291.5: To apply programming to solve simple numerical method problems, namely rot finding of function, Differentiation of function and simple integration

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-CS291.1	2	3	1	1	1	1	2	3	-	2	3	1	2	2	1	-
ES-CS291.2	3	1	2	1	2	1	-	-	3	2	2	2	3	2	3	2
ES-CS291.3	1	3	1	2	2	-	2	3	3	2	3	2	2	-	3	3
ES-CS291.4	2	3	3	2	-	2	1	2	2	3	1	-	2	3	2	2
ES-CS291.3	3	3	2	2	2	2	1	-	3	3	2	3	3	3	2	1
Average	2.2	2.6	1.8	1.6	1.4	1.2	1.2	1.6	2.2	2.4	2.2	1.6	2.4	2.0	2.2	1.6

Subject Code- CE(ES)391	**Category- Engineering Science Course**	
Subject Name- Basic Electronics	**Semester- 3rd**	
L-T-P- 1L+2P	**Credit-2**	
Theory		
Module 1	Diodes and Applications covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode asaRectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings,Applications;	4L
Module 2	Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor(FET)– Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal OxideSemiconductor (MOS) FETs, Introduction to CMOS circuits;	4L
Module 3	Transistor Amplifiers and Oscillators covering, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies,Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;	4L
Module 4	Operational Amplifiers and Applications covering, Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741Op-Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground;	4L
Practical		
Module 1	Laboratory Sessions covering, Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread BoardsandPrinted Circuit Boards (PCBs); Identification, Specifications, Testing of Active Devices – Diodes,BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs;	
Module 2	Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency ofSinusoidalSignals using Lissajous Patterns on CRO; (CRO);	
Module 3	Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator, Input and OutputCharacteristics of BJT in Common Emitter (CE) Configuration, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration;	
Module 4	Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain and Bandwidth of BJT Common Emitter (CE) Amplifier, Gain and Bandwidth of JFET Common Source(CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers,Oscillation Frequency of BJT based RC Phase Shift, Hartley and Colpitts Oscillators;	
Module 5	Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Op-Amp Applications – Differentiator and Integrator, Square Wave and Triangular Wave Generation, Applications of 555 Timer – Astable and MonostableMultivibrators;	
Module 6	Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); Truth Tables and Functionality of Flip-Flops – SR, JK and DFlip-Flop ICs; Serial-In-Serial-Out and Serial-In-Parallel-Out Shift operations using 4- bit/8-bit ShiftRegister ICs; Functionality of Up-Down / Decade Counter ICs;	

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor devices and their applications.
2. Design an application using Operational amplifier.
3. Understand the working of timing circuits and oscillators.
4. Understand logic gates and importance of it in digital system.

5. Learn flip flop as a building block of digital systems.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(ES)391.CO1	3	2	2	1	-	-	-	-	-	2	-	-	1	-	-
CE(ES)391.CO2	2	2	2	-	-	-	-	-	-	2	-	-	1	-	-
CE(ES)391.CO3	2	2	2	-	-	-	-	-	-	2	-	-	2	-	-
CE(ES)391.CO4	2	3	2	-	-	-	-	-	-	2	-	-	2	-	-
CE(ES)391.CO5	1	1	1	-	-	-	-	-	-	1	-	-	1	-	-
Average	2	2	1.8	1	-	-	-	-	-	1.8	-	-	1.4	-	-

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering systems or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties.

OmDayal Group of Institutions
Department of Chemistry

Course Code : CE(BS)301	**Category :** Basic Science Courses
Course Title : **Biology (Biology for Engineers)**	**Semester** : Third
Duration: 2L+1T	**Credit:3**

Course Objectives:

To introduce modern biology with an emphasis on evolution of biology as a multi-disciplinary field and to make students aware of application of engineering principles in biology and engineering robust solution inspired by biological examples.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction** Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlightthe fundamental importance of observations in any scientific inquiry	2
2	**Classification:** Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity-Unicellular or multicellular (b) ultrastructure prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus.	3
3	**Genetics** Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4

4	**Biomolecules** Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	4
4	**Macromolecular analysis:** Purpose: To analyze biological processes at the reductionistic level. Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5
5	**Enzymes** Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	4
6	**Information Transfer** Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	4
7	**Macromolecular analysis** Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements	5
7	**Immunology** Purpose: How does the immune system work? What are the molecular and cellular components and pathways that protect an organism from infectious agents or cancer? This comprehensive course answers these questions as it explores the cells and molecules of the immune system. Immunology- Self vs Non-self, pathogens, human immune system, antigen-antibody reactions.	5
8	**Metabolism** Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4
9	**Microbiology** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3

Course Outcomes:

1. To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.

2. To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted
3. To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" and the molecular basis of coding and decoding genetic information is universal
4. To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine and to analyses biological processes at the reductionist level
5. To convey that without catalysis life would not have existed on earth and to study the fundamental principles of energy transactions are the same in physical and biological world

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(BS)301.CO1	2	-	-	-	2	2	_	_	_	_	_	3
CE(BS)301.CO2	1	2	-	-	1	2	3	-	-	-	-	3
CE(BS)301.CO3	1	3	2	-	2	2	3	-	-	-	-	3
CE(BS)301.CO4	-	2	-	-	1	1	2	-	-	-	-	3
CE(BS)301.CO5	2	2	1	-	-	2	2	-	-	-	-	3
Average	1.5	2.25	1.5	-	1.5	1.8	2.5	-	-	-	-	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(BS)302	Category: Basic Science Course
Subject Name: Mathematics-III (Transform & Discrete Mathematics)	Semester: **III**
L-T-P: **2-0-0**	Credit:**2**

Course Objectives:

To motivate or challenge students to understand the concept the different types polynomial and Laplace transform, set, relation , group theory , basic counting theory and study the propositional logic and syntax.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Transform Calculus 1:-** Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials; place Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.	6
2	**Transform Calculus-2:** Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and theirapplications.	6
3	**Sets, relations and functions**: Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types ofrelations, their compositions and inverses. Different types of functions, their compositions andinverses	4
4	**Propositional Logic**: Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deductiontheorem, etc. Decision problems of propositional logic. Introduction to first order logic and firstorder theory	4
5	**Partially ordered sets**:-Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices.Boolean and pseudo Boolean lattices	4
6	**Algebraic Structures**: Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange'stheorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures.Error correcting code. Algebraic structures with two binary operations- ring, integral domain, and field. Boolean algebra and Boolean ring (Definitions and simple examples only).	4
7	**Introduction to Counting** Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation,combination, summations. Introduction to recurrence relation and generating functions.	3
8	**Introduction to Graphs**: Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.	3

Course Outcomes:

On completion of the course students will be able to

1. Develop the skill of evaluating Laplace and inverse Laplace transform to solve ODEs and PDEs.

2. On completion of the course students will express a logic sentence in terms of predicates, quantifiers, and logical connectives.
3. Derive the solution for a given problem using deductive logic and prove the solution on based of a logical inference.
4. Classify its algebraic structure for a given a mathematical problem.
5. Develop the given problem as graph networks and solve with techniques of graph theory.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(BS)302.CO1	2	3	3	3	_	1	_	_	_	_	_	3
CE(BS)302.CO2	_	3	3	3	_	_	_	_	_	_	_	3
CE(BS)302.CO3	-	2	3	3	_	_	_	_	_	_	_	3
CE(BS)302.CO4	-	3	1	3	_	2	_	_	_	_	_	3
CE(BS)302.CO5	-	3	3	3	_	1	_	_	_	_	_	3
Average	2	2.8	2.6	3	_	1.33	_	_	_	_	_	3

PO1: Engineering Knowledge

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PO5: Modern Tool Usage

PO6: The Engineer and Society

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PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of English

Course Code : CE HS 301	**Category :** Humanities Courses
Course Title : Humanities - I (Effective Technical Communication)	**Semester** : Third
L-T-P : **3-1-0**	**Credit:3**

COURSE OBJECTIVE :

To help students develop basic proficiency in English Grammar, Vocabulary and Composition, and writing skills.
To help students identify common errors in writing and gain editing skills in the process.
To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs and emails.
To help students develop their respective personalities,values, ethics and attitudes, suitable enough for dealing with others in professional set ups.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Information Design and Development- Different kinds of technical documents,Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for onlinemedia.	4L
2	Technical Writing, Grammar and Editing- Technical writing process, forms of discourse,Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors,Managing technical communication projects, time estimation, Single sourcing, Localization.	8L
3	Self Development and Assessment- Self assessment, Awareness, Perception andAttitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time;Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity	8L
4	Communication and Technical Writing- Public speaking, Group discussion, Oral;presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing Reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.	8L
5	Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes,Téléphone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work Culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving,Creativity.	8L

Course Outcome :

After completing this course, the students will be able to
1. Understand the dynamics of Verbal and Non Verbal aspects of technical communication
2. Practice multi-step writing process to plan, draft, and revise reports, correspondence, and presentations.
3. Illustrate and examine the knowledge of ethical aspects of engineering
4. Demonstrate and explain social and professional etiquettes
5. Plan self-development and practice self-assessment to function on multi-disciplinary teams.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HMHU501.CO1	-	2	-	2	-	1	-	2	1	3	1	3
HMHU501.CO2	-	-	1	1	-	1	-	2	-	3	-	3
HMHU501.CO3	-	2	2	2	-	2	1	3	3	3	2	3
HMHU501.CO.4	-	2	1	-	-	-	1	3	2	3	-	3
HMHU501.CO.5	-	1	1	1	-	1	1	3	1	3	1	3
Average:	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

PO1: Engineering Knowledge

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PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

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PO8: Ethics

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PO10: Communication

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PO12: Life-long Learning

CO-PO MAPPING

Subject Code: CE(HS)302	Category: Engineering Science Course
Subject Name: Introduction to Civil Engineering	Semester: III
L-T-P: 1+1+0	Credit: 2

Course Objective

To study the basic concepts about civil engineering. Drawing regarding residential and public building.

Module No	Description of Topic	Contact Hours
Module 1	Basic Understanding: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career Tutorials Develop a matrix of various disciplines and possible roles for engineers in each.	1
Module 2	History of Civil engineering: Early constructions and developments over tim e; Ancient monuments & Modern marvels; Development of various materials of construction and methods Of construction; Works of Eminent civil engineers Tutorials Identify 10 ancient monuments and ten modern marvels and list the uniqueness of each	1
Module 3	Overview of National Planning for Construction and Infrastructure Develop ment; Position of construction industry vis-à vis other industries, five year plan outlays for construction; current budgets for infrastructure works Tutorials Develop a Strategic Plan for Civil Engineering worksfor next ten years base d on past investments and identify one typical on going mega project in each area	1
Module 4	Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities Tutorials Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each; List down the possible systems required for a typical Smart City	1

Module 5	Fundamentals of Building Materials: Stones, bricks, mortars, Plain, Reinforced &Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes Tutorials Identify three top new materials and their potential inconstruction; Visit a C oncrete Lab and make a report	2
Module 6	Basics of Construction Management & Contracts Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management Tutorials Identify 5 typical construction methods and list theiradvantages/ positive features	2
Module 7	Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction Tutorials Sustainability principles, Sustainable built environment, water treatment systems, and good practices of wastewater management. Examples of Solid and hazardous waste management, Air pollution and control	2
Module 8	Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; varioustypes of foun dations; basics of rock mechanics & tunnelling Tutorials List top five tunnel projects in India and their features collect and study Geotechnical investigation report of any one Metro Rail (underground) project; Visit a construction site and make a site visit report	2
Module 9	Hydraulics, Hydrology &Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi-purpose reservoir projects Tutorials Identify three river interlinking projects and theirfeatures; visit a Hydraulics Lab and make a report	1
Module 10	Ocean Engineering: Basics of Wave and Current Systems; Sediment transport systems; Ports & Harbours and other marine structures Tutorials Identify 5 typical ports in India and list the structuresavailable in them; Visit a related/similar facility, if possible in nearby place and make a report	1

Module 11	Power Plant Structures: Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects Tutorials Collect the typical layout for a large thermal powerplant and a large hydro power plant and identify all the structures and systems falling in them.	1
Module 12	Structural Engineering: Types of buildings; tall structures; various types of b ridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies; Tutorials Identify 5 unique features for typical buildings,bridges, tall structures and la rge span structures; Visit Structures Testing Lab/facility and make a report	3
Module 13	Surveying & Geomatics: Traditional surveying techniques, Total Stations, D evelopment of Digital Terrain Models; GPS, LIDAR; Tutorials Collect visual representations prepared by a TotalStation and LIDAR and co mpare; Study typical Google street map and Google Earth Map and study how each can facilitate the other	1
Module 14	Traffic &Transportation Engineering: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport Development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction And management; Case studies and examples Tutorials Investments in transport infrastructure; Developments and challenges; Intelligent Transport Systems; Smart Cities, Urban Transport; Road Safety; Sustainable and resilient highway design principles; Plan a sustainabletransport system for a city; Identify key features/components in the planning and design of a green field highway/airport /port/railway and the cost –economics.	1
Module 15	Repairs & Rehabilitation of Structures: Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non- Destructive testing systems; Use of carbon fiber wrapping and carbon composites in repairs. Tutorials Collect the history of a major rehabilitation project andlist the interesting features	1
Module 16	Computational Methods, IT, IoT in Civil Engineering: Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD,…GEOSTU	2

	DIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM, …) Tutorials Visit an AutoCad lab and prepare a report; Identify teninteresting software systems used in Civil Engg. and their key features	
Module 17	Industrial lectures: Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning; Tutorials For each case study list the interesting features	2
Module 18	Basics of Professionalism: Professional Ethics, Entrepreneurial possibilities in Civil Engineering, Possibilities for creative & innovative working, Technical writing Skills enhancement; Facilities Management; Quality & HSE Systems in Construction Tutorials List 5 cases of violation of professional ethics and list preventive measures; Identify 5 interesting project sand their positive features; Write 400 word reports on one ancient monument and a modern marvel of civilengineering	3

Course Outcomes:

At the end of the course, the student will be able to:
CO1. Understand basic disciplines of civil engineering, History of civil engineering and ancient monuments and the concept of national planning for construction and infrastructure development.
CO2. Understand the fundamentals of architecture & town planning, fundamentals of building materials and construction management.
CO3. Understand the fundamentals of environmental engineering and sustainability.
CO4. Understand the basic concepts of Geotechnical, hydraulics, water resource and ocean engineering.
CO5. Understand the fundamentals of Power plant structure, structural engineering, surveying and traffic & transportation engineering. Understand the fundamentals of repairs and rehabilitation of Structures. Understand the basic principles of computational method, IT, IOT in civil engineering. Understand the application of civil engineering knowledge in industry, basics of professionalism.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:
PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools
PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements
PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes/PSO → Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS03
CE(HS)302.1	1	-	-	-	-	-	-	-	-	-	-	-	1	2	3
CE(HS)302.2	2	-	-	-	-	-	1	-	-	-	2	-	2	2	3
CE(HS)302.3	2	1	-	-	-	-	2	-	-	-	-	-	3	3	3
CE(HS)302.4	2	1	-	-	-	-	1	-	-	-	-	-	3	3	3
CE(HS)302.5	2	1	1	-	1	-	-	3	-	-	2	-	3	3	3
Average	1.8	1	1	0	1	0	1.33	3	0	0	2	0	2.4	2.6	3

1: Slightly 2: Moderately 3: Substantially

<u>OmDayal Group of Institutions</u>

Department of Civil Engineering

Subject Code: CE (ES) 392	Category: Engineering Science Course
Subject Name: Computer-Aided Civil Engineering Drawing	Semester: III
L-T-P: 1+0+2	Credit: 2

Prerequisites: knowledge in Geometrical Drawing, Computer Operation and Basic Engineering Drawing

Course Objectives:

The objective of this course is to make student able to Learn to sketch and take field dimensions and to take data and transform it into graphic drawings and Auto Cad skills.

Course Content:

Module No	Description of Topics	Contact Hrs.
Module 1	INTRODUCTION Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co-ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.	2
Module 2	SYMBOLS AND SIGN CONVENTIONS Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards	2
Module 3	MASONRY BONDS English Bond and Flemish Bond – Corner wall and Cross walls -One brick wall and one and half brick wall	1
Module 4	BUILDING DRAWING Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity	5
Module 5	PICTORIAL VIEW Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information	2

	Modelling (BIM)	
Drawings		
1	Buildings with load bearing walls including details of doors and windows.	6
2	Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500-700 words	4
3	RCC framed structures	6
4	Reinforcement drawings for typical slabs, beams, columns and spread footings	6
5	Industrial buildings - North light roof structures – Trusses	4
6	Perspective view of one and two storey buildings	4

After completing the course, the student will be able to

1. Operate standard Computer Aided Design software
2. Study and interpret civil engineering drawing
3. Gain knowledge on masonry brickwork
4. Prepare details drawing of building
5. Understand and prepare 3D modelling of buildings

PROGRAM SPECIFIC OUTCOMES (PSOs) The student will be:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes → / **Course outcome** ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE (ES) 392.1	3	-	-	-	3	-	-	-	-	-	-	2	1	-	-
CE (ES) 392.2	3	1	-	1	3	1	-	-	-	-	1	2	2	1	-
CE (ES) 392.3	3	-	-	-	-	-	1	-	-	-	-	-	-	3	-
CE (ES) 392.4	3	1	1	1	3	-	-	1	1	2	1	3	2	1	1
CE (ES) 392.5	3	1	1	1	3	1	-	-	-	-	-	1	2	-	-
Average	3.0	1.0	1.0	1.0	3.0	1.0	1.0	1.0	1.0	2.0	1.0	2.0	1.8	1.7	1.0

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(ES)302	Category: Engineering Science Course
Subject Name: ENERGY SCIENCE & ENGINEERING	Semester: III
L-T-P: 1+1+0	Credit: 2

Course Objective

To familiarize with the all forms of renewable energy Resources.

The objectives of this course is understand need of these sources due to crisis of conventional sources and the familiarize with non conventional sources. To impart knowledge on the atmosphere and its present condition and, global warming. To learn the green buildings concepts applicable to alternate design. To learn sufficient knowledge on energy monitoring methods and optimal regulations. To Comprehend the techniques available for energy conservation in electrical utilities.

Module No	Description of Topic	Contact Hours
Module 1	Introduction to Energy Science Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment. Tutorials: Compile a World map showing Energy Reserves by source, Total Energy consumption, Per capita energy consumption and Carbon Footprint	3
Module 2	Energy Sources Overview of energy systems, sources, transformations, efficiency, andstorage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & Alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen, Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power project s, superconductor-based energy storages, high efficiency batteries) Tutorials: Compile a Word Map showing Alternative Energy Source usage; Compile a Process diagram for a Pumped Storage project; Collect details of a typical North Sea oil platform. Compile a map of India showing exiting potential and utilized potential for hydro power.	4

Module 3	Energy & Environment Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carb on footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and env ironmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy Tutorials: Study the functioning of an Electro Static Precipitator in thermal power plant; study the uses of course and fine Fly Ash from thermal power plants. Compile the safety provisions in design and construction of a reactor containment building	5
Module 4	Civil Engineering Projects connected with the Energy Sources Coal miningtechnologies, Oil exploration offshore platforms, Und erground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, Wind mill towers; hydropower stations above-ground and underground along with associated dams, tunnels, penstocks, etc. Nuclear reactor containment buildings and associated buildings, Design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems Tutorials: Compile a process diagram for a typical underground hydropower project; Collect detail of a model solar chimney project; collect details of a wave energy project at Vizhinjam ; Collect details of the Kalpasar (Tidal energy) project	10
Module 5	Engineering for Energy conservation Concept of Green Building and Green Architecture; Green Building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption. Tutorials: Draw a typical geometrical orientation of a house in your areato a void sun’s radiation In the bed room in the evening Identify typical examples of Indian buildings having Various LEED ratings; List various building materials with their embodied energy content. Do an Energy Audit of your Departmental Building in the college	8

Course Outcome

On completion of the course students will be able to

CO1. To get a familiar knowledge in various forms of energy resources. Explain renewable energy sources & systems .

CO 2. Apply engineering techniques to build solar, wind, tidal, geothermal, biofuel, fuel cell, Hydrogen and sterling engine.

CO 3. Analyze and evaluate the implication of renewable energy. Concepts in solving numerical Problems pertaining to solar radiation geometry and wind energy systems.

CO 4. Technical aspects of Global Warming will make them understand the impact they have On climate. Will be familiar with climate responsive building design and basic concepts.

CO 5. Familiarized about the energy sources, energy acts, and energy auditing and energy management methods. Perform energy audit in an Industry

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(ES)301	Category: Engineering Science Course
Subject Name: Engineering Mechanics	Semester: III
L-T-P: 3+1+0	Credit: IV

Course Objective:

The primary purpose of the study of engineering mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering. This capacity requires more than a mere knowledge of the physical and mathematical principles of mechanics; also required is the ability to visualize physical configurations in terms of real materials, actual constraints ,and the practical limitations which govern the behaviour of machines and structures.

Module No.	Description of Topic	Contact Hours
Module1	**IntroductiontoEngineeringMechanics** Force Systems Basic concepts, Particleequilibrium in 2-D & 3-D; Rigid Body equilibrium;System of Forces, Coplanar Concurrent Forces,Components in Space – Resultant- Moment ofForcesanditsApplication;CouplesandResultantofForceSystem, EquilibriumofSystemof Forces,Freebodydiagrams,EquationsofEquilibriumofCoplanarSystemsandSpatialSystems; Static Indeterminacy	3
Module2	**Friction** Typesoffriction,Limitingfriction,LawsofFriction,StaticandDynamicFriction;MotionofBodies, wedgefriction,screwjack&differentialscrewjack;	3
Module3	**BasicStructuralAnalysis** Equilibriuminthreedimensions;MethodofSections;MethodofJoints;Howtodetermineifamemberisintensionorcompression;SimpleTrusses;Zeroforcemembers;Beams&typesof beams;Frames&Machines;	4
Module4	**CentroidandCentreofGravity** Centroid of simple figures from first principle,centroid of composite sections; Centre of Gravityanditsimplications;Areamomentofinertia-Definition,Momentofinertiaofplanesections from first principles, Theorems of moment of inertia,Moment of inertia of standard sections andcompositesections;Massmomentinertiaofcircularplate, Cylinder,Cone,Sphere, Hook.	5
Module5	**Virtual Workand EnergyMethod-** Virtualdisplacements,principleofvirtualworkforparticleandidealsystemofrigidbodies,degreesoffreedom.Activeforcediagram,systemswithfriction,mechanicalefficiency. Conservativeforcesandpotentialenergy(elasticandgravitational),e	4

	nergyequationforequilibrium.Applicationsofenergy method forequilibrium.Stabilityofequilibrium.	
Module6	**Reviewof particledynamics-** Rectilinearmotion;Planecurvilinearmotion(rectangular,path,andpolarcoordinates).3-Dcurvilinearmotion;Relativeandconstrainedmotion;Newton's2nd law(rectangular,path,and polarcoordinates).Work-kineticenergy,power,potentialenergy.Impulse-momentum(linear,angular);Impact(Directand oblique).	4
Module7	**Introductionto Kineticsof RigidBodies** Basic terms, general principles indynamics; Types of motion, Instantaneous centre of rotation inplanemotionandsimpleproblems;D'Alembert'sprincipleandits applicationsinplanemotion andconnectedbodies;Workenergyprincipleanditsapplicationinplanemotionofconnectedbodies;Kinetics ofrigid bodyrotation;	5
Module8	**MechanicalVibrations** Basicterminology,freeandforcedvibrations,resonanceanditseffects;Degreeoffreedom;Derivationforfrequencyandamplitudeoffreevibrationswithoutdampingandsingledegreeof freedomsystem,simpleproblems,typesofpendulum,useofsimple,compoundandtorsionpendulums;	5
Tutorials	Fromtheabovemodulescovering,Tofindthevarious forcesandanglesincluding resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon onvariousforces;Tofindcoefficientoffrictionbetweenvariousmaterialsoninclinedplan;Free bodydiagramsvarioussystemsincluding block-pulley;Toverifytheprinciple ofmomentin thediscapparatus; Helicalblock;Todraw a load efficiencycurveforascrewjack	6

Course Outcomes:

Upon completion of this course, students will be able to:

1. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
2. Apply basic knowledge of maths and physics to solve real-world problems.
3. Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts).
4. Understand dynamics concepts – force, momentum, work and energy, the work-energy principle, impulse-momentum principle and the coefficient of restitution and solve dynamic problems.
5. Extend all of concepts of linear kinetics to systems in general plane motion (application of Euler's Equation) and get introduction to friction and vibration.

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties.

Mapping of Course outcomes with Program outcomes

PO/PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(ES)301.CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CE(ES)301.CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CE(ES)301.CO3	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CE(ES)301.CO4	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CE(ES)301CO.5	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
Average	3	2	1.33	-	-	-	-	-		-	-	-	3	-	-

1. Slightly 2. Moderately 3. Substantially

OmDayal Group of Institutions
Department of Chemistry

Course Code : CE(ES)393	**Category :** Basic Science Courses
Course Title : Life Science	**Semester** : Third
L-T-P : **1-0-2**	**Credit:2**

Course Objectives:

To introduce modern biology with an emphasis on evolution of biology as a multi-disciplinary field and to make students aware of application of engineering principles in biology and engineering robust solution inspired by biological examples.

Course Content:

Module 1A	**Plant Physiology** Transpiration; Mineral nutrition	3 L
Module 1B	**Ecology** Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids;	3 L
Module 2A	**Population Dynamics** Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity;	3 L
Module 2B	**Environmental Management** Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental ImpactAssessment- Case studies (International Airport, thermal power plant);	3 L
Module 3A	**Molecular Genetics** Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept	3 L
Module 3B	**Biotechnology** Basic concepts: Totipotency and Cell manipulation; Plant &Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Techniques and applications	3 L
Module 4	**Biostatistics** Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor)	4 L
Module 5	**Laboratory & Fieldwork Sessions** Comparison of stomatal index in different plants; Study of mineral crystals in plants; Determination of diversity indices in plant communities; To construct ecological pyramids of population sizes in an ecosystem; Determination of Importance Value Index of a species in a plant community; Seminar (with PPTs) on EIA of a Mega-Project (e.g., Airport, Thermal/Nuclear Power Plant/ Oil spill scenario); Preparation and extraction of genomic DNA and determination of yield by UV absorbance; Isolation of Plasmid DNA and its separation byGel Electrophoresis; Data analysis using Bio-statistical tools;	**15 P**

Course Outcomes:

1. To study about ecosystems and plant physiology
2. To study about environmental management
3. To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences” and the molecular basis of coding and decoding genetic information is universal
4. Basic concepts of Biotechnology
5. Data analysis using statistics.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(ES)393.CO1	-	-	-	-	-	2	2	2	-	-	-	2
CE(ES)393.CO2	-	-	-	-	-	2	2	2	-	-	-	2
CE(ES)393.CO3	-	2	-	-	-	2	2	-	-	-	-	2
CE(ES)393.CO4	2	2	-	-	2	2	-	-	-	-	-	2
CE(ES)393.CO5	2	2	-	-	-	2	-	-	-	-	-	2
Average	2	2	-	-	2	2	2	2	-	-	-	2

PO1: Engineering Knowledge
PO2: Problem Analysis
PO3: Design/Development of Solutions
PO4: Conduct Investigations of Complex Problems
PO5: Modern Tool Usage
PO6: The Engineer and Society
PO7: Environment and Sustainability
PO8: Ethics
PO9: Individual and Team Work
PO10: Communication
PO11: Project Management and Finance
PO12: Life-long Learning

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: **CE(ES)402**	Category: **Engineering Science Course**
Subject Name: **STRENGTH OF MATERIALS**	Semester: **IV**
L-S-P: **2 – 0 - 0**	Credit: **2**

PREREQUISITE: Physics, Mathematics, Basic Calculus and Engineering Mechanics (CE(ES)301)

COURSE OBJECTIVE

To understand the basic principles of strength of structural materials that would be pertinent to simple design of elements

Module No.	DESCRIPTIONS OF TOPIC	CONTACT HOURS
Module-1	**Review of Basic Concepts of Stress and Strain:** Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety, Beam Statics: Support reactions, concepts of redundancy, axial force, shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments in simply supported beams, cantilever and overhanging beams	6 H
Module-2	**Symmetric Beam Bending:** Basic kinematic assumption, moment of inertia, elastic flexure formulae and its application, Bending and shear stress for regular sections, shear centre	3 H
Module-3	**Deflection of statically determinate beams**: Fundamental concepts: Elastic curve, moment Curvature relationship, governing differential equation, boundary conditions: Direct integration solution	4 H
Module-4	**Analysis of determinate plane trusses**: Concepts of redundancy, Analysis by method of joints, method of sections	4 H
Module-5	**Two Dimensional Stress Problems**: Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle	3 H
Module-6	**Introduction to thin cylindrical & spherical shells**: Hoop stress and meridional - stress and volumetric changes	3 H
Module-7	**Torsion**: Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical; springs	4 H
Module-8	**Columns:** Fundamentals, criteria for stability in equilibrium, column buckling theory, Euler's load for columns with different end conditions, limitations of Euler's theory – problems, eccentric load and secant formulae.	3 H

Course Outcomes (COs):

After going through this course, the students will be able to:

CO1. To identify the equilibrium conditions and elastic properties of axially loaded bars through stress-strain and force-displacement curves.

CO2. To identify the principal plane and principal stresses through Mohr circle.

CO3. To calculate the hoop and meridional stresses in thin cylinders and spherical shells and also identify different degrees of freedoms for support conditions like hinge, roller and fixed constraints.

CO4. To calculate the bending moment, shear force and deflection of beams for uniformly distributed, concentrated, linearly varying and external concentrated moment and also calculate the member forces in a plane truss using Method of Joint and Method of Section.

CO5. To identify torsional moment and twist on a circular shaft and calculate the shear stress, know the concepts of strain energy due to axial load, bending and shear and will also be able to calculate the buckling load of columns using Euler's theory for different support constraints

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CE(ES)402. 1	3	-	-	-	-	-	-	-	-	-	-	-
CE(ES)402. 2	3	3	-	2	-	-	-	-	1	-	-	-
CE(ES)402. 3	3	3	-	2	-	-	-	-	1	-	-	1
CE(ES)402. 4	3	3	-	2	-	-	-	-	1	-	-	1
CE(ES)402. 5	3	3	-	2	-	-	-	-	1	-	-	1
Average	3	3	-	2	-	-	-	-	1	-	-	1

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(ES)493	Category: Engineering Science Course
Subject Name: Engineering Geology Laboratory	Semester: IV
L-T-P: 0+0+2	Credit: 1

Prerequisite: Knowledge of basic physics and chemistry

Course Objective

To expose the students to identify the minerals and rocks based on their inherent properties and uses in civil engineering, to educate the students in the interpretation of the geological maps related to civil engineering projects. Students will learn the dip and strike, thickness of strata, Bore hole problems related to geological formation related to foundation, tunnels, reservoirs and mining. Students will understand the Field

Module No	Description of Topic	Contact Hours
Module 1	Knowledge of basic physics and chemistry	2
Module 2	Identification of minerals in hand specimen	2
Module 3	Identification of igneous rocks in hand specimen	2
Module 4	Identification of metamorphic rocks in hand specimen	2
Module 5	Study of crystals with the help of crystal models	2
Module 6	Study of geologic structures with the help of models	2
Module 7	Interpretation of geological maps: horizontal, vertical, uniclinal, folded and faulted structures	2
Module 8	Microscopic study of rocks and minerals	2

knowledge by visiting the site like problems Faults, Folds, Joints, Unconformity etc.

Course Outcome

On completion of the course students will be able to
CO1 Define and state the role of engineering geology in civil engineering
CO2 Understand origin of rocks and geologic structures
CO3 Apply different tools to identify rocks and minerals in hand specimen and under microscope
CO4 Analyse the geological structures through drawing the cross sections from the geological maps
CO5 Evaluate the results obtained from different geological experiments. Investigate the natural hazards/disasters that are caused by the geological reasons

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:
PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools
PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements
PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes/ PSO → / Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	-	-	-	2	2	1	2		-	2	1	1	2
CO 2	3	3	2	2	3	2	3	2	3	1	-	3	3	2	2
CO 3	3	3	3	1	3	2	3	2	3	2	-	3	1	-	2
CO 4	1	2	2	2	2	1	2	2	3	2	-	3	3	2	3
CO 5	3	3	3	3	2	3	3	2	2	-	-	2	2	3	3
Average	2.4	2.4	2.5	2	2.5	2	2.6	1.8	2.6	1.67	0	2.6	2	2	2.4

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Basic Science and Humanities

Subject Code: CE(MC)401	Category: **Mandatory Courses (Non Credit)**
Subject Name: Organisation Behaviour	Semester: Mandatory
L-T-P: **2-0-0**	Credit:**0**

Course Objectives:

1. To help the students to develop cognizance of the importance of human behaviour.
2. To enable students to describe how people behave under different conditions and understand why people behave as they do.
3. To provide the students to analyse specific strategic human resources demands for future action.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to Organizational Behaviour-Concept, Importance, Challenges and Opportunities Personality-Meaning of Personality, Personality Determinants and Traits, Psychoanalytic Theory, Argyris Immaturity to Maturity Continuum Impact on organization. Attitude-Concept, Components, Cognitive Dissonance Theory, Attitude Surveys	5
2	Perception- Concept, Nature and Importance, Process of Perception, Factors influencing perception, Perceptual Selectivity, Shortcuts to Judge Others: Halo Effect, Stereotyping, Projection and Contrast Effects, Impact on Organization. Motivation-Definition, Theories of Motivation-Maslow's Hierarchy of Needs Theory, McGregor's Theory X&Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory	6
3	Leadership-Concept, Leadership Styles, Theories-Behavioural Theory: Ohio Studies, Michigan Studies, Blake & Mouton Managerial Grid; Contingency Theory: Fielder Theory. Group Behaviour: Definition, Characteristics of Group, Types of Groups: Formal & Informal; Stages of Group Development, Group Decision making, Group Decision Making Vs Individual Decision Making.	8
4	Organizational Design-Various organizational structures and their pros and cons. Concepts of organizational climate and culture, Organizational PoliticsConcept, Factors influencing degree of Politics Conflict management- Concept, Sources of conflict, Stages of conflict process, Conflict resolution techniques, Tools-Johari Window to analyse and reduce interpersonal conflict, Impact on organization	5

Course Outcomes:

1. Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization.

2. Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.

3. Analyze the complexities associated with management of the group behavior in the organization.

4. Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.

5. accept and embrace in working with different people from different cultural and diverse background in the workplace.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CEMC401.CO1	-	-	-	-	-	-	-	1	3	2	-	3
CEMC401.CO2	-	-	-	-	-	1	-	2	2	3	-	3
CEMC401.CO3	-	-	-	-	-	-	-	1	-	3	-	3
CEMC401.CO4	-	-	-	-	-	-	-	2	2	3	-	3
CEMC401.CO5	-	-	-	-	-	-	-	-	2	2	-	3
Average	-	-	-	-	-	.2	-	1.2	1.8	2.6	-	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

CO-PO AND MAPPING

Subject Code: CE(HS)401	Category: HUMANITIES AND SOCIAL SCIENCES
Subject Name: CIVIL ENGINEERING SOCIETAL & GLOBAL IMPACT	Semester: IV
L-T-P: 2+1+0	Credit: 2

Prerequisite: Introduction to Civil Engineering and Energy science & Engineering. SKILLS: Aware of the importance of Civil Engineering and impact on the society. Aware of the impact of Civil Engineering for various fields of human endeavour. Innovative thinking to ensure sustainability

Course Objective:

The course is designed to provide a better understanding of the impact which Civil Engineering has on the Society at large and on the global arena. Civil Engineering projects have an impact on the Infrastructure, Energy consumption and generation, Sustainability of the Environment, Aesthetics of the environment, Employment creation, Contribution to the GDP, and on a more perceptible level, the Quality of Life. It is important for the civil engineers to realise the impact which this field has and take appropriate precautions to ensure that the impact is not adverse but beneficial. The objectives of this course is understand need of these sources due to crisis of conventional sources and the familiarize with non-conventional sources

MODULE NO	DESCRIPTIONS OF TOPIC	CONTACT HOURS
Module 1	Introduction to Course and Overview; Understanding the past to look into the future: Preindustrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and application for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis;	3
Module 2	Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering	3
Module 3:	Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar Photovoltaic, Solar Chimney), Wind, Wave Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;	8
Module 4:	Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.	7
Module 5:	Built environment- Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent / Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability	5

Module 6	Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment (projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development	4

COURSE OUTCOMES (CO):

At the end of the course, students would be able to -----
CO1. The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively Outline the role of Civil engineering in evolution and revolution of mankind and globally present status of development in India.
CO2. Estimate the level of resource utilization for present and future infrastructural projects using various tools/methods.
CO3. The extent of Infrastructure, its requirements for energy and how they are met: past, present and future. Infer the necessity of different conventional as well as futuristic infrastructural projects.
CO4. The Sustainability of the Environment, including its Aesthetics. Incorporate the goal of sustainable development to minimize the potential impacts on the global environment.
CO5.The Built Environment and factors impacting the Quality of Life. Associate various measures for enhancing the build environment, thereby improving quality of life of the occupants. The potentials of Civil Engineering for Employment creation and its Contribution to the GDP. Evaluate the potential of Civil Engineering for employment creation and its contribution to the GDP.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:
PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools
PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements
PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes /PSO → Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	2	1	1	-	-	-	1	-	3	2	3
CO 2	-	-	-	-		1	1	-	-	-	1	-	-	3	3
CO 3	-	-	-	-	2	1	1	-	-	-	1	-	3	-	3
CO 4	-	-	-	-	2	1	1	-	-	-	1	-	3	2	3
CO 5	-	-	-	-	1	1	1	-	-	-	1	-	-	3	3
Average	-	-	-	-	1.7	1	1	-	-	-	1	-	3	2.5	3

1: Slightly 2: Moderately 3: Substantially

Subject Code: **CE(PC)402**	Category: **Professional Core Courses**
Subject Name: **Environmental Engineering-I**	Semester: **IV**
L-T-P: **2-1-0**	Credit: **3**

Prerequisite: Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Engineering Mechanics, Fluid Mechanics and Hydraulics.

Course Objectives:

Student should be able to make technology choice to deal with water quality issues, operate and maintain working treatment systems and do troubleshooting of the problems in these systems. The student will be able to apply the knowledge gained from the subject in EIA studies for water component and water pollution control strategies.

Course Content:

Module No	Description of Topic	Hours/ Week
1	**Water Requirement Estimation** Water Demand: Different types of water demand; Per capita demand;Variations in demand; Factors affecting water demand. Future Demand Forecasting: Design period; Population forecastingmethods	4
2	**Sources of Water** Surface Water Sources; Ground Water Sources	6
3	**Water Quality** Water Quality Characteristics: Physical, Chemical, and Biological parameters. Drinking Water Standards: BIS; WHO; USEPA Water Quality Indices: Basic concept and examples	6
4	**Water Treatment** Typical flow chart for surface and groundwater treatments Unit Operation and Processes: Aeration, Plain Sedimentation, Sedimentation with Coagulation and Flocculation, Water Softening, Filtration, Disinfection	12
5	**Water Conveyance and Distribution** Hydraulic design of pressure pipes; Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs.	6
6	**Characteristics of Municipal Solid Waste (MSW)** Composition and characteristics of MSW	2
7	**Handling of MSW** Generation, collection and transportation of MSW	2
8	**Engineered Systems for MSW Management** Methods of reuse/ recycle, energy recovery, treatment and disposal ofMSW	2

Course Outcomes:

After going through this course, the students will be able to:

1. Define the basic concepts and terminologies of water supply engineering and solid waste management
2. Describe different surface and groundwater sources; and composition and characteristics of municipal solid waste. Apply the methods of quantifying water requirement and MSW generation
3. Solve different mathematical problems regarding different components of water supply systems, distribution networks and MSW management systems
4. Compare between different water samples based on their physical, chemical and biological characteristics
5. Design different unit processes and operations involved in water treatment and MSW management

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping of Course outcomes with Program outcomes															
POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	3			2				1	3	1	2	1
CO2	3	2	3	2	3	2	2			1	1	2	3	2	3
CO3	3	1	2	2	3			1	1	1		1	2	2	3
CO4	3		2		3	2	2		1			2	3	2	3
CO5	1	2		2	2	2	3		1	1		2	3	2	3
	2.4	1.75	2.5	2.5	2.75	2	2.25	1	1	1	1	2	2.4	2	2.6

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE (PC) 494	Category: Professional Core Course
Subject Name: Concrete Technology Laboratory	Semester: IV
L-T-P: 2+0+0	Credit: 1

Course Objective:

The course relates to the fundamentals related to concrete and concrete material, besides dealing with masonry, reinforcement, etc. The course begins with an outline of what concrete is, what are the processes involved in formation of concrete, various materials that are used in concrete formation, properties of each ingredient of concrete, standard tests to be applied to concrete and concrete ingredients. The course then moves on to design-mix, special concretes, Non-destructive testing, etc.

CE(PC)494	Concrete Technology Laboratory	2P	1 Credits
Prerequisite	Concrete Technology CE(PC)404		
Test on Fine aggregates	Bulking, Specific gravity, Bulk Density, Percentage voids, Fineness Modulus. Grading curve.		
Test on Coarse aggregates	Specific gravity, Bulk Density, Percentage voids, Fineness Modulus. Grading curve.		
Test on Cement	Normal consistency, fineness, Initial setting and final setting time of cement. Specific gravity, soundness and Compressive strength of Cement.		
Test on Fresh Concrete	Concrete mix design, Various workability tests – slump, compacting factor, vee-bee test.		
Test on Hardened Concrete	Spilt-tensile strength test, Flexure test, NDT Tests (Rebound hammer and Ultra-sonic pulse velocity), Poission ratio.		

Course Outcomes (COs)

After going through this Course, the students will be able to:

CO 1. Demonstrate the method and findings of tension and compression tests on concrete.

CO 2. Understand the concept of different tests on hardened concrete.

CO 3. Find out mix proportion of high grade of concrete.

CO 4. Measure the workability of concrete mix.

CO 5. Understand the different properties of cement.

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes → / Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE (PC) 494. CO 1	3	-		1	1	-	-	-	-	-	-	-	3	2	-
CE (PC) 494. CO 2	3	2		1	1	-	-	-	-	-	-	-	3	2	-
CE (PC) 494. CO 3	3	2		1	1	-	-	-	-	-	-	-	3	2	-
CE (PC) 494. CO 4	3	2		1	1	-	-	-	-	-	-	-	3	2	-
CE (PC) 494. CO 5	3	2		1	1	-	-	-	-	-	-	-	3	2	-
Avg.	3	2		1	1								3	2	

1: Slightly 2: Moderately 3: Substantially

<u>OmDayal Group of Institutions</u>

Department of Civil Engineering

Subject Code: CE(PC)404	Category: Engineering Professional Course
Subject Name: CONCRETE TECHNOLOGY	Semester: IV
L-T-P: 2+1+0	Credit: 3

<u>Prerequisites</u>: Introduction to Civil Engineering CE(HS)302, Chemistry BS-CH101.

COURSE OBJECTIVE

The course relates to the fundamentals related to concrete and concrete material, besides dealing with masonry, reinforcement, etc. The course begins with an outline of what concrete is, what are the processes involved in formation of concrete, various materials that are used in concrete formation, properties of each ingredient of concrete, standard tests to be applied to concrete and concrete ingredients. The course then moves on to design-mix, special concretes, Non-destructive testing, etc.

MODULE NO	DESCRIPTIONS ITEM	CONTACT HOURS
Module 1	Cement: Manufacturing of cement, Oxides composition of cement and the calculation of compounds, Heat of hydration, Types of cement-OPC, RPC. Low heat cement, PPC, PSC, Sulphate resisting cement, High Alumina cement, Expansive cement, White cement; Test on cement- fineness, consistency, initial setting time & final setting time, soundness test, strength test, specific gravity of cement, storage of cement.	**8**
Module 2	Aggregates: Classification, Grading, alkali aggregate reaction, Deleterious substances in aggregates, physical properties, testing of aggregates- fineness modulus, bulking, specific gravity, sieve analysis, flakiness & elongation index. Quality of Water for mixing and curing - use of sea water for mixing concrete.	**4**
Module 3:	Properties of fresh concrete: Workability, factors affecting workability, segregation and bleeding, tests on workability- slump test, compacting factor test, vee-bee test, flow table test.	**4**
Module 4:	Properties of Hardened concrete: Tensile & compressive strength, flexural strength, stress strain characteristics, modulus of elasticity, Poisson’s ratio, Creep, shrinkage, permeability of concrete, micro cracking of concrete.	**4**

MODULE NO	DESCRIPTIONS ITEM	CONTACT HOURS
Module 5:	Strength of concrete: curing methods, water-cement ratio. gel-space ratio, maturity of concrete,	**4**
Module 6	Admixtures: types, uses, superplasticizers, plasticizers, Bonding admixtures.	**3**
Module 7	Mix Design – Objective, factors influencing mix proportion - Mix design by I.S.10262-2019. (with & without admixture)	**4**
Module 8	Non-destructive test: Rebound hammer and Ultra-sonic pulse velocity testing methods. Quality control - Sampling and testing, Acceptance criteria.	**4**
Module 9	Special Concrete – Ferrocement - Fibre reinforced concrete - Polymer concrete Special Concrete – Ferro cement - Fibre reinforced concrete - Polymer concrete - Sulphur Concrete - Self compacting concrete. Ready mix concrete, Batching plant. - Sulphur Concrete - Self compacting concrete. Ready mix concrete, Batching plant.	**5**

Course Outcomes (COs):

At the end of the course, students would be able to :

CO1. To test all the required properties of concrete materials as per IS code to ensure quality control while testing/ sampling . Identify the materials used to make concrete; including their sources, production and properties

CO2. To compute the properties of concrete at fresh and hardened state. Describe and carry out tests relevant to the use of fresh and hardened concrete

CO3. To design concrete mix with and without admixtures as per latest IS code methods.

CO4. Design the special type of concrete for specific application purposes. Classify the different types of concrete based on their applications

CO5. To ensure quality control while testing/ sampling .Perform various NDT on concrete structures and to study crack repair and rehabilitation of concrete structures

PROGRAM SPECIFIC OUTCOMES (PSOs) The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: Able to understand the necessity of Civil Engineering solutions in a economical, Environmental and societal context.

Mapping of Course outcomes with Program outcomes

CO-PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC) 404.1	2	-	-	-	2	-	-	-	-	3	1	3	3	1	3
CE(PC) 404.2	2	-	-	1	2	-	-	-	-	3	1	3	3	1	3
CE(PC) 404.3	2	-	-	-	2	-	-	-	-	3	1	3	3	1	3
CE(PC) 404.4	2	-	-	1	2	-	-	-	-	3	1	3	3	1	3
CE(PC) 404.5	2	-	-	1	2	-	-	-	-	3	1	3	3	1	3
AVERAGE	2	-	-	1	2	-	-	-	-	3	1	3	3	1	3

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(ES) 491	Category: Engineering Science Lab
Subject Name: Fluid Mechanics Laboratory	Semester: 4th
L-T-P: 0-0-2	Credit: 1
Prerequisite: Introduction to Solid Mechanics (CE(ES) 401)	

Course Objective

Enrich the concept of fluid mechanics and hydraulic machines.

Correlate various flow measuring devices such as venturimeter, orifice meter and notches etc.

Course Syllabus

Experiment 1	Calibration of Notches
Experiment 2	Calibration of Orifice meter
Experiment 3	Determination of Hydraulic Coefficient of an Orifice
Experiment 4	Performance Test on Centrifugal Pump
Experiment 5	Performance Test on Reciprocating Pump
Experiment 6	Determination of Minor Losses in Pipes due to Sudden Enlargement and Sudden Contraction
Experiment 7	Performance Test on Pelton Wheel Turbine
Experiment 8	Measurement of water surface profile for flow over Broad crested weir
Experiment 9	Measurement of water surface profile for a hydraulic jump

Course Outcome:

After going through this course, the students will be able to:

1. Calibrate the notch and orifice meter.
2. Evaluate the performance of pump and turbine.
3. Determine the various hydraulic coefficients.
4. Determine the minor losses through pipes.
5. Measure the water surface profile due to formation of hydraulic jump and flow over Broad crested weir.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

CO-PO Mapping:

Program outcomes/ PSO → **Course ↓ outcome**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(ES) 491.1	3	2	-	-	1	-	-	-	2	1	-	-	3	3	3
CE(ES) 491.2	3	2	-	-	1	-	-	-	2	1	-	-	3	3	3
CE(ES) 491.3	3	2	-	-	1	-	-	-	2	1	-	-	3	3	3
CE(ES) 491.4	3	2	-	-	1	-	-	-	2	1	-	-	3	3	3
CE(ES) 491.5	3	2	-	-	1	-	-	-	2	1	-	-	3	3	3
Average	3	2	-	-	1	-	-	-	2	1	-	-	3	3	3

Note:

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(ES)401	Category: Engineering Science courses
Subject Name: Introduction to Fluid Mechanics	Semester: 4th
L-T-P: 2-0-0	Credit: 1
Prerequisite: Introduction to Civil Engineering, Physics.	

Course Objective

1. Students will learn the basic properties of fluid
2. They will be able to mathematically analyze simple flow situations.
3. They will learn the dimensional analysis.
4. They will be able to evaluate the performance of pumps.
5. They will be able to evaluate the performance of turbines.

Course Syllabus

Module No	Description of Topic	ContactHrs.
1	Properties of fluids: Fluid – definition, distinction between solid and fluid – Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension.	3
2	Fluid statics: Pressure at a point, basic equation for pressure field, pressure variation in a fluid at rest- incompressible fluid, compressible fluid, absolute pressure, gauge pressure; pressure measurements by manometers – general, inclined, inverted, micro-manometer; pressure and forces on submerged planes and curved surfaces, centre of pressure, buoyancy and floatation, Stability of submerged and floating bodies, metacentric height.	4
3	Fluid Kinematics: The velocity field, Eulerian and Lagrangian flow descriptions, concepts of: - one-, two- and three-dimensional flows, steady and unsteady flows, streamlines, streaklines, pathlines; The acceleration field; Control volume and system representation, Continuity Equation, Momentum Equation, Moment-of-momentum equation, applications to pipe bends.	6

4	Fluid Dynamics: Application of Newton's Law along a streamline, Bernoulli Equation, Kinetic energy head, potential energy head and pressure energy head, total energy head, Pitot tube, Examples of use of Bernoulli Equation, measurement of flows - venturimeter, energy line and hydraulic grade line.	7
5	Dimensional Analysis: Buckingham Pi Theorem, determination of Pi terms, correlation of experimental data, examples.	3
6	Flow through Pipes: Laminar flow, Reynolds number, critical velocity, turbulent flow, shear stress at pipe wall, velocity distribution, loss of head for laminar flow, Darcy-Weisbach Formula, friction factor, contraction and expansion head losses. Concept of boundary layer and its growth.	7
7	Pipeline Systems: Pipes in series, pipes in parallel, equivalent pipes, branching pipes, pipe networks.	7
8	Hydraulic Machines: Basics of hydraulic machines, specific speed of pumps and turbines.	3

Course Outcome:

On successful completion of this course, student should be able to:

1. define basic terms, values and laws in the areas of fluids properties, statics, kinematics and dynamics of fluids, and hydraulic design of pipe systems;
2. describe methods of implementing fluid mechanics laws and phenomena while analyzing the operational parameters of hydraulic problems;
3. practically apply tables and diagrams, and equations that define the associated laws;
4. calculate and optimize operational parameters of hydraulic problems;
5. explain the correlation between different operational parameters;

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

CO-PO Mapping:

Program outcomes/ PSO → **Course ↓ outcome**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)401.1	3	3	1	1	1	-	-	-	-	-	-	2	3	3	3
CE(PC)401.2	3	2	2	1	1	-	-	-	-	-	-	2	3	3	3
CE(PC)401.3	3	2	1	1	1	-	-	-	-	-	-	2	3	3	3
CE(PC)401.4	3	3	2	1	1	-	-	-	-	-	-	2	3	3	3
CE(PC)401.5	3	-	-	2	-	-	-	-	-	-	-	2	3	3	3
Average	3	2.5	1.5	1.2	1	-	-	-	-	-	-	2	3	3	3

Note:

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

<u>OmDayal Group of Institutions</u>

Department of Civil Engineering

Subject Code: CE(PC)401	Category: Engineering Science Course
Subject Name: Soil Mechanics – I	Semester: IV
L-T-P: 2+1+0	Credit: 3

<u>Course Objective:</u>

To provide students with basic understanding of physical and mechanical properties of soil, together with knowledge of basic engineering procedures to identify factors controlling soil behaviour and methods to determine soil properties. Students will acquire basic knowledge in engineering design of geotechnical systems

Module No.	Description of Topics	Contact hours
Module 1	**PHYSICAL PROPERTIES OF SOILS:** **Soil Formation** Introduction, Origin of Soil, Formation and Types of soil, Formative classification, Typical Indian Soil, Some Special Types of Soils, Structure and Composition, Clay Mineralogy. **Soil as a Three Phase System** Basic Definitions, Weight - Volume Relationship, Measurement of Physical Properties of Soil: Insitu Density, Moisture Content, Specific Gravity, Relative density, Functional Relationships.	15
	Index Properties of Soil Introduction, Particle Size Distribution, Mechanical Analysis - Sieve Analysis, Sedimentation Analysis – Hydrometer and Pipette Methods. Consistency of Soil – Atterberg Limits, Different Indices, Discussion on Limits and Indices. **Classification of Soil** Classification by Structure, Particle Size Classification, Textural System, PRA System (AASHTO Classification), Unified Classification System, As per IS Code Recommendation, Field Identification of Soil, Classification by Casagrande's Plasticity Chart.	
Module 2	**Soil Hydraulics** Modes of Occurrence of Water in Soil – Free Water, Held Water, Structural Water, Capillary Water, Gravitational Water, Adsorbed Water, Pore Water, Pore Water Pressure, Effective Pressure, Total Pressure, Effective Pressure under Different Conditions and in Different Cases of Flow through Soils, Critical Hydraulic Gradient, Quick Sand Condition.	4
Module 3:	**Permeability** Introduction, Darcy's Law, Coefficient of Permeability, Discharge Velocity, Seepage Velocity, Factors Affecting Permeability. Determination of Coefficient of Permeability – Constant Head and Falling Head Methods, Permeability of Stratified Soil Deposits, Field Determination of Permeability – Unconfined and Confined Aquifers.	4

Module 4:	**Seepage Analysis** Introduction, Seepage, Seepage Pressure, Two Dimensional Flow, Laplace's Equations, Continuity equation, Flow Nets, Flow through Earthen Dam, Estimation of Seepage, Construction, Properties and Use of Flow Nets, Piping and Heaving, Uplift due to Seepage, Design of Fillers.	4
Module 5:	**STRESS DISTRIBUTION IN SOILS** Introduction, Geostatic Stress, Boussinesq's Equation, Determination of Stress due to Point Load, Vertical Stress Distribution on a Horizontal Plane, Isobar and Pressure Bulb, Vertical Stress Distribution on a Vertical Plane, Vertical Stress under Uniformly Loaded Circular Area, Vertical Stress Beneath a Corner of a Rectangular Area, Equivalent Point Load Method, 2:1 Method, Newmark's Influence Chart, Vertical Stress Beneath Line and Strip Loads. Westergaard Analysis, Comparison of Boussinesq and Westergaard Theories, Contact Pressure.	6
Module 6	**SHEARING STRENGTH OF SOILS** Shear Strength of Soil Introduction, Basic Concept of Shear Resistance and Shear Strength of Soil, Mohr Circle of Stress, Sign Conventions, Mohr - Coulomb Theory, Relationship between Principal Stresses and Cohesion. Determination of Shear Parameters of Soil Stress Controlled and Strain Controlled Tests, Laboratory Determination of Soil Shear Parameters- Direct Shear Test, Triaxial Test, Classification of Shear Tests Based on Drainage Conditions, Unconfined Compression Test, Vane Shear Test as per Relevant IS Codes. Stress- Strain Relationship of Clays and Sands, Concept of Critical Void Ratio. Skempton's Pore Pressure Parameters. Sensitivity and Thixotropy of clay. Concept of Stress path.	8

Course Outcomes:

After going through this course, the students will be able to:

1. Classify soil as per grain size distribution curve and understand the index properties of soil.
2. Apply the concept of total stress, effective stress and pore water pressure for solving geotechnical problems.
3. Assess the permeability of different types of soil and solve flow problems.
4. Estimate the seepage loss, factor of safety against piping failure using flow net related to any hydraulic structure.
5. Determine vertical stress on a horizontal plane within a soil mass subjected to different types of loading on the ground surface and also the maximum stressed zone or isobar below a loaded area.

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes / Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)401.CO1	3	2											3	-	-
CE(PC)401.CO2	3	2											3	2	-
CE(PC)401.CO3	3	2	1										3	2	-
CE(PC)401.CO4	3	2	1										3	3	-
CE(PC)401.CO5	3	2	2										3	1	-

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(ES)492	Category: Engineering Science Lab
Subject Name: Solid Mechanics Laboratory	Semester: 4th
L-T-P: 0-0-2	Credit: 1
Prerequisite: Introduction to Solid Mechanics (CE-ES402)	

Course Objective

To understand the measurement of mechanical properties of materials

To understand the deformation behaviour of materials

Course Syllabus

Experiment 1	Tension test on Structural Materials: Mild Steel and Tor steel (HYSD bars)
Experiment 2	Compression Test on Structural Materials: Timber, bricks and concrete cubes
Experiment 3	Bending Test on Mild Steel
Experiment 4	Torsion Test on Mild Steel Circular Bar
Experiment 5	Hardness Tests on Ferrous and Non-Ferrous Metals: Brinnel and Rockwell Tests
Experiment 6	Test on closely coiled helical spring
Experiment 7	Impact Test: Izod and Charpy
Experiment 8	Demonstration of Fatigue Test

Course Outcome:

After going through this course, the students will be able to:

1. Demonstrate the method and findings of tension and compression and bending tests on ductile and brittle materials.
2. Demonstrate the method and findings of Torsion test and fatigue test on mild steel circular bar and concrete beam.
3. Illustrate the concept of hardness and explain the procedure and findings of Brinnel and Rockwell tests.
4. Demonstrate the concept and procedure of calculation of spring constant and elaborate its use in Civil Engineering.
5. Demonstrate the method and findings of Izod and Charpy impact tests.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

CO-PO Mapping:

Program outcomes/ PSO → / **Course** ↓ **outcome**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)403.1	3	2	2	-	2	-	-	-	3	-	-	2	1	2	2
CE(PC)403.2	3	2	2	-	2	-	-	-	3	-	-	2	1	1	2
CE(PC)403.3	3	2	2	-	2	-	-	-	3	-	-	2	1	2	2
CE(PC)403.4	3	2	2	-	2	-	-	-	3	-	-	2	3	3	2
CE(PC)403.5	3	2	2	-	2	-	-	-	3	-	-	2	3	3	2
Average	3	2	2	-	2	-	-	-	3	-	-	2	1.8	2.2	2

Note:

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(PC)493	Category: Engineering Professional Course
Subject Name: Surveying & Geomatics Laboratory	Semester: IV
L-T-P: 0+0+2	Credit: 1

Prerequisite: Surveying & Geomatics [CE(PC)403]

Course Objective

The objective of this course is appreciated of the need for lifelong learning through the discussion of recent changes in survey procedures and equipment and also have the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in surveying.

Module No	Description of Topic	Contact Hours
Module 1	Traverse survey by Prismatic Compass: Procedure; Computation and checks on closed traverse; Preparation of field book; Plotting the traverse; Sources of errors.	2
Module 2	Theodolite Survey: Closed traverse by transit theodolite, Preparation of field book	2
Module 3	Differential Levelling using Dumpy level: Collimation and Rise and Fall methods, Field book preparation	2
Module 4	Total Station Survey: Traversing and Levelling	2
Module 5	Visual Image Interpretation	2
Module 6	Satellite Image Pre-processing	2
Module 7	Digital Image Classification and Accuracy Assessment	2
Module 8	Stereoscopic fusion of aerial photographs using mirror stereoscope	2

Course Outcome

On completion of the course students will be able to
CO1 State the interdependency and advancement of different surveying methods
CO2 Comprehend the working principles of different surveying and geomatics instruments and experiments
CO3 Execute the different methods of surveying and geomatics to measure the features of interest
CO4 Examine the results obtained from the surveying and geomatics experiments
CO5 Critically appraise the different techniques of surveying and geomatics in measuring and assessing the features of interest. Design and construct solutions for real world problems related to surveying and geomatics.

PROGRAM SPECIFIC OUTCOMES (PSOs):
The student will be able:
PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools
PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements
PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes/ PSO → Course ↓ outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)493.1	2	3	2	-	-	-	-	-	-	-	-	3	1	2	3
CE(PC)493.2	2	3	2	-	-	3	-	-	-	-	-	3	2	-	3
CE(PC)493.3	2	3	2	-	-	-	-	-	-	-	-	3	2	2	3
CE(PC)493.4	-	3	2	-	3	-	-	-	3	-	2	3	3	3	3
CE(PC)493.5	-	3	-	-	3	-	-	-	-	-	3	3	3	3	3
Average	2	3	2	0	3	3	0	0	3	0	2.5	3	2.2	2.5	3

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(PC)403	Category: Engineering Professional Course
Subject Name: Surveying & Geomatics	Semester: IV
L-T-P: 2+1+0	Credit: 3

Prerequisite: Knowledge of Mathematics and Physics in Class-XII

Course Objective

The objective of this course is appreciated of the need for lifelong learning through the discussion of recent changes in survey procedures and equipment and also have the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in surveying.

Module No	Description of Topic	Contact Hours
Module 1	Principles of Surveying: Introduction, Principles and classification of surveying; Concept of scales; Survey stations and lines – ranging and bearing; Chain surveying – Concept, Instruments, numerical problems on errors due to incorrect chain; Plane table surveying – Advantages, disadvantages, parts, methods; Elements of simple and compound curves.	5
Module 2	Levelling: Levelling – Principles, Precautions and Difficulties; Differential levelling, -- Concepts and numerical problems; Contouring.	4
Module 3	Triangulation and Trilateration: Theodolite survey – Instruments, measurements of horizontal and vertical angles; Triangulation – Network, signals, numerical examples; Baseline measurement – site selection, measuring equipment's numerical problems on baseline corrections; Trigonometric levelling – Axis signal correction.	5
Module 4	Advanced Surveying: Principle of Electronic Distance Measurement (EDM); Types of EDM instruments; Distomats; Total Station – Parts, advantages, applications, field procedure and errors; Global Positioning System (GPS) – Concept, applications, segments, location determination, errors; Principle of Differential GPS; Terrestrial laser scanner.	6
Module 5	Photogrammetric Surveying: Concept; Classification of photogrammetric surveying – terrestrial, aerial and satellite; scale of a vertical photograph; relief displacement and object height determination; Stereoscopic vision – depth perception, parallactic angle, stereoscopes; Object height determination using parallax; Parallax bar; Flight planning – Concept and numerical problems; Photo mosaic; Orthophotography; Stereoscopic plotting instruments.	6
Module 6	Remote Sensing: Energy sources and radiation principles; Concept of Electromagnetic Spectrum; Energy interactions in the atmosphere and earth surface features; Data acquisition and interpretation; Platforms and sensors – Geostationary and sun- synchronous orbits, push broom and whiskbroom scanning system, characteristics of IRS, Landsat and Sentinel sensors; Visual image interpretation	5

Module 7	Digital Image Processing: Concept; Image rectification and restoration; Image enhancement; Image classification; Accuracy assessment and post classification smoothing.	6
Module 8	Applications of Geomatics in Civil Engineering: 3D mapping; Earthquake and landslides; Runoff modelling; Groundwater targeting; Flood risk assessment; Urban planning; Highway and transportation	6

Course Outcome

On completion of the course students will be able to

CO1 Define and state the scope of surveying and geomatics in civil engineering

CO2 Understand the basic principles of surveying and geomatics engineering

CO3 Apply the different methods of surveying and geomatics to measure the features of interest

CO4 Analyse the traditional and advanced methods of surveying

CO5 Evaluate the different techniques of surveying and geomatics in solving real world problems. Design and construct solutions for real world problems related to surveying and geomatics.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Program outcomes/ PSO → **Course ↓ outcome**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)403.1	3	3	3	2	3	1	1	1	3	3	3	3	1	2	3
CE(PC)403.2	3	3	3	2	2	2	1	1	3	2	3	2	1	1	2
CE(PC)403.3													1	2	3
CE(PC)403.4	3	3	3	3	2	2	1	1	3	2	2	2	3	3	3
CE(PC)403.5	3	3	3	3	2	1	1	1	3	2	1	2	3	3	3
Average	3	3	3	2.5	2.25	1.5	2	2	3	2.25	2.25	2.25	2.2	2.6	2.8

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Civil Engineering

Subject Code: **CE(PC)506**	Category: **Professional Core Course**
Subject Name: **Transportation Engineering**	Semester: **V**
L-T-P: **2-1-0**	Credit: **3**

Prerequisite:

Class XII level knowledge of Physics, Mathematics, Undergraduate level knowledge of Engineering Mechanics, Strength of Materials, Soil Mechanics

Course Objectives:

The objective of this course is to appreciate the need for lifelong learning through the discussion of recent changes and studies of highway and transportation engineering, also have the ability to apply knowledge of mathematics, science, and engineering to understand the design techniques and equipment used in highway engineering.

Course Content:

Module No	Description of Topic	Contact Hrs.
Module 1	**Introduction to Highway Engineering** Scope of Highway Engineering; Jayakar Committee Report: Recommendations – CRF, IRC, CRRI; Scope of Motor Vehicle Act; Recommendations of Nagpur Roadconference; RoadClassificationas perthird20 years road development plan(1981-2001);Basictypesof RoadPatterns and its scope of application	3 Hrs
Module 2	**Highway alignment** Factors controlling Highway Alignment; Engineering Surveys for HighwayAlignment.	2 Hrs
Module 3	**Geometric Design** Crosssectional elements of highway;DesignParameters(as per IRC) – Vehicledimensions,Carriagewaywidth,Designspeed, Frictional coefficients (Lateral and Longitudinal) etc; Design Principles of Horizontal Alignment: Camber, Sight Distance (PIEVtheory, SSD, OSD, ISD); Horizontal Curves – [Radius, Super elevation, Extrawidening, Set back distance, Tr	12 Hrs

	ansition curve];DesignPrinciples of Vertical Alignment: Gradients; Grade Compensation;Vertical Curves – Summit Curve, Valley curve.	
Module 4	**Traffic Engineering** Traffic studies: Fundamental parameters of Traffic Flow (speed, flow, density,capacity)and their basic relations; Basics of Spot Speed Studies-Speed andDelay study- O & D study; Intersections and Channelization: At Grade and Grade Separated intersections;Conflict points;Salientfeaturesof Rotary;Traffic Signs; Signal Design – Basicconcepts ofIRC designmethod, 2 phasesignal design by Webster method.	10 Hrs
Module 5	**Pavement Design** Pavement materials: Bitumen, Aggregate, Subgrade soil; Types of Pavement: Flexible and Rigid pavements and their typical cross-sections; Design parameters: Wheel Load, ESWL, Tyre Pressure, CBR, Resilient Modulus&Poisson'sRatio of variouslayers,Subgrade Modulus etc. Design of Flexible Pavement using IRC 37:2018 Design of Rigid Pavement: Wheel Stresses, Frictional Stresses and WarpingStresses;Expansion, Contraction and Construction Joints; Design of RigidPavement thickness,Dowel Bar and Tie Bar;Distresses in Pavements	13 Hrs
Module 6	**Sustainability** Scope of adoption of sustainable construction techniques by using recyclable hazardous materials fly ash, plastics, recyclable construction materials.	2 Hrs

Course Outcomes (COs):

At the end of the course, the student will be able to:

1. Understand the knowledge of planning, design and the fundamental properties of highway materials in highway engineering.

2. Apply the knowledge of geometric design and draw appropriate conclusion

3. Interpret the concept of different methods in design, construction of the pavement.

4. Interpret traffic parameters by applying the knowledge in traffic planning and intersection design.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CE(PC)506. 1	3	3	2	-	1	2	3	2	-	1	1	2	3	3	2
CE(PC)506. 2	3	3	3	-	2	-	-	-	-	2	-	2	3	2	1
CE(PC)506. 3	3	3	3	2	1	1	-	1	-	2	-	2	3	2	1
CE(PC)506.4	3	3	2	2	2	-	-	-	1	1	-	2	3	1	-
Average	3	3	2.5	2	1.5	1.5	3	1.5	1	1.5	1	2	3	2	1.33

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: **CE(PC)591**	Category: **Professional Core Course**
Subject Name: **RC Design Sessional**	Semester: **V**
L-T-P: **0 – 0 - 2**	Credit: **1**

PREREQUISITE: Design of RC Structures (CE(PC)501)

COURSE OBJECTIVE

The objective of the course is to make students ready for the design of various reinforced concrete members like beam, slab, column, footing, etc and also detailing of the same.

Course Outcomes (COs):

On successful completion of this course, student should be able to:

1. Understand material properties and design methodologies for reinforced concrete structures.
2. Assess different type of loads and prepare layout for reinforced concrete structures.
3. Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members
4. Analyze and design various structural elements of reinforced concrete buildings like beam, slab, column, footing, and staircase.
5. Assessment of serviceability criteria for reinforced concrete beam and slab and prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CE(PC)591. 1	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CE(PC)591.2	3	2	-	-	-	-	-	1	-	-	-	2	3	1	-
CE(PC)591. 3	3	1	-	1	-	-	-	2	-	-	-	3	3	1	-
CE(PC)591.4	3	3	3	2	-	-	-	2	-	-	-	2	3	3	-
CE(PC)591.5	3	2	-	-	-	-	-	2	-	-	-	-	3	2	-
Average	3	2	3	1.5				1.75				2.33	2.6	1.75	

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: **CE(PC)596**	Category: **Professional Core Course**
Subject Name: **Transportation Engineering Laboratory**	Semester: **V**
L-T-P: **0 – 0 - 2**	Credit: **1**

PREREQUISITE: Transportation Engineering (CE(PC)506)

COURSE OBJECTIVE

To expose the students to various experiments on road aggregates, bitumen and subgrade soil.

EXPERIMENT NO	DESCRIPTIONS OF TOPIC	CONTACT HOURS
Introduction	Introduction on pavement construction materials	-
Experiment 1	Shape test of aggregate	2H
Experiment 2	Crushing Strength Test of aggregate	2H
Experiment 3	Impact test of aggregate	2H
Experiment 4	Los Angeles Abrasion test of aggregate	2H
Experiment 5	Specific Gravity and Water Absorption test of aggregate	2H
Experiment 6	Specific Gravity test	2H
Experiment 7	Penetration test	2H
Experiment 8	Static or Kinematic viscosity	2H
Experiment 9	Softening point test	2H
Experiment 10	Flash and Fire Point test	2H
Experiment 11	Ductility test	2H
Experiment 12	CBR value of sub-grade (Soaked and unsoaked)	4H
Experiment 13	Marshall Stability test	4H
Demonstration	Demonstration on Stripping value and Loss on heating tests of bitumen,	2H
	Benkelman Beam and Bump Integrator test	4H

Course Outcomes (COs):

On successful completion of this course, student should be able to:

CO 1. Experiment and identify the various properties of road aggregates

CO 2. Determine the grades and other properties of bitumen and their suitability of use at different condition

CO 3. Determine the CBR percentage value of Soil and requirement of overlay thickness from the Benkelman Beam deflection test result

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CE(PC)596. 1	3	-	-	2	-	1	-	-	3	3	-	2	3	1	3
CE(PC)596. 2	3	-	-	2	-	1	-	-	3	3	-	3	3	1	3
CE(PC)596. 3	3	2	2	2	1	1	-	-	3	3	-	3	3	1	3
Average	3	2	2	2	1	1	-	-	3	3	-	2.67	3	1	3

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(PC)597	Category: Professional Core Courses
Subject Name: Computer Applications in Civil Engineering	Semester: V
L-T-P: 2+0+0	Credit: 1

Prerequisites: ES-CS291 Programming for Problem Solving, CE(ES)392 Computer-aided Civil Engineering Drawing

Course Objectives:

Students will learn how to identify and solve various design and analysis problems in different fields of Civil Engineering to be solved using computers. Students will be able to solve analysis and design problems in areas like surveying, hydraulics, structural analysis, RCC design, soil mechanics and foundation, transportation, water resources, etc

Module No	Description of Topic	Contact Hrs.
Module 1	Introduction: Concept of problem-solving using computer, use of programming language and software for problem solving; Identification of various design and analysis problems in different fields of Civil Engineering to be solved using computers; Procedure, formulae and data related to the analysis and design of such problems.	2
Module 2	Use of spreadsheets: Learning spreadsheets like MS Excel, matrix analysis, use of Goal Seek and Solver, Optimization Tools; Plotting. Applications to problems involving tabular data, CE estimation, surveying, and design problems.	7
Module 3	Programming Languages: Learning at least one language: Fortran 2003/2008/2018, C++11/C++14, Python 3, VBA 7.0; Computing platforms like Matlab/Scilab/MathCAD; Solving analysis and design problems in areas like surveying, hydraulics, structural analysis, RCC design, soil mechanics and foundation, transportation, water resources, etc.	10
Module	Use of Software: Familiarity with widely	10

4	used Civil Engineering software like STAAD Pro, HECRAS, HEC-HMS, SWMM, Mx Roads, etc.; Solving at least two such analysis/design problems.	

Course Outcomes: At the end of the course, the student will be able to:

1. Identify and formulate Civil Engineering problems solvable by using computers as a problem-solving tool.
2. Perform linear algebra and matrix operations and their application to solve Civil Engineering problems
3. Solve sets of linear equations and determine roots and nonlinear equations
4. Construct, interpret and solve simple optimization problems and Develop programs for Civil Engineering analysis and design problems.
5. Use various software used in industries for analysis and design.

PROGRAM SPECIFIC OUTCOMES (PSOs) The student will be:

6. PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of
7. science, mathematics and engineering leveraging skills, techniques and various modern tools
8. PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements
9. PSO3: To manifest professional and ethical responsibilities while discharging duties

<u>Mapping of Course outcomes with Program outcomes</u>

Program outcomes → / **Course outcome** ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)597.1	3	3	3	2	3	-	-	-	-	-	-	2	3	-	-
CE(PC)597.2	3	3	3	2	3	-	-	-	-	-	-	2	3	-	-
CE(PC)597.3	3	3	3	2	3	-	-	-	-	-	-	2	3	-	-
CE(PC)597.4	3	3	3	2	3	1	-	1	-	2	-	2	3	1	1
CE(PC)597.5	3	3	3	2	3	1	-	1	-	2	-	3	3	1	1
Average	3.0	3.0	3.0	2.0	3.0	1.0	-	1.0	-	2.0	-	2.2	3.0	1.0	1.0

1: Slightly 2: Moderately 3: Substantially

Subject Code: **CE(PC)501**	Category: **Professional Core Courses**
Subject Name: **Design of RC Structure**	Semester: **V**
L-T-P: **2-1-0**	Credit: **3**

PREREQUISITE:

Introduction to Solid Mechanics [CE(ES)402], Concrete Technology [CE(PC)404].

COURSE OBJECTIVES:

1. Students will be able to perform analysis and design of reinforced concrete members and connections and be able to identify and interpret the appropriate relevant industry design codes.
2. To become familiar with professional and contemporary issues in the design and construction of reinforced concrete members.

COURSE CONTENT:

Module No	Description of Topic	Hours/ Week
1	**Introduction:** Principles of design of reinforced concrete members - Working stress and Limit State method of design	1
2	**Working stress method of design:** Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces - Balanced, under reinforced and over reinforced beam/ slab sections; design of singly and doubly reinforced sections	4
3	**Limit state method of design**: Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces; concepts of bond stress and development length; Use of 'design aids for reinforced concrete (SP: 16).	7
4	**Beam Design by LSM:** Analysis, design and detailing of singly reinforced rectangular, 'T', 'L' and doubly reinforced beam sections by limit state method.	5
5	**Slab Design by LSM:** Design and detailing of one-way and two-way slab panels as per IS code provisions	3
6	**Continuous slab and beam design by LSM:** Design and detailing of continuous beams and slabs as per IS code provisions	3
7	**Design of Staircases by LSM**: Types; Design and detailing of reinforced concrete dog legged staircase	4
8	**Design of Columns by LSM**: Design and detailing of reinforced concrete short columns of rectangular and circular cross sections under axial load. Design of short columns subjected to axial load with moments (uniaxial and biaxial bending) – using SP 16.	5
9	**Design of Foundation by LSM:** Design and detailing of reinforced concrete isolated square and rectangular isolated and combined footing for columns as per IS code provisions by limit state method Design and detailing of Pile foundation as per IS code provisions.	8

COURSE OUTCOMES (COs):

After going through this course, the students will be able to:

CO1. Understand material properties and design methodologies for reinforced concrete structures.
CO2. Assess different types of loads and prepare layout for reinforced concrete structures.
CO3. Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members.
CO4. Analysis and design of various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase.
CO5. Assessment of serviceability criteria for reinforced concrete beam and slab. Prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.
PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.
PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping Of Course Outcomes with Program Outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)501-CO1	2	1	-	2	-	1	1	-	-	1	-	3	2	1	2
CE(PC)501-CO2	3	3	1	3	-	2	3	1	1	-	1	3	3	3	1
CE(PC)501-CO3	1	1	-	-	2	-	1	-	1	1	-	3	1	1	1
CE(PC)501-CO4	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
CE(PC)501-CO5	2	1	2	1	3	1	3	3	3	3	3	3	3	2	3
AVG.	2.2	1.6	2	2	2.67	1.25	2.2	2	1.75	1.75	2	3	2.4	1.8	2

1: Slightly 2: Moderately 3: Substantially

Subject Code: **CE(PC)503**	Category: **Professional Core Courses**
Subject Name: **Structural Analysis – I**	Semester: **V**
L-T-P: **2-1-0**	Credit: **3**

PREREQUISITE:

Introduction to Solid Mechanics [CE(ES)402]

COURSE OBJECTIVES:

To provide knowledge about determinate and indeterminate structures and how to calculate degree of indeterminacy of a structure, applications and analysis of determinate and indeterminate structures in various aspects.

COURSE CONTENT:

Module No	Description of Topic	Hours/ Week
1	**Basics of Structural Analysis:** Concept of static and kinematic indeterminacy, Determination of degree of indeterminacy for different types of structures. Theorem of minimum potential energy, law of conservation energy, principle of virtual work, the first and second theorems of Castigilano, Betti's law, Clark Maxwell's theorem of reciprocal deflection	4
2	**Analysis of Determinate Structures:** Portal Frames, Three hinged arches, Cables	5
3	**Deflection of Determinate Structures:** Energy methods. Unit Load method for beams, Deflection of trusses and Simple Portal Frames.	5
4	**Influence Line Diagram:** Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shear.	9
5	**Analysis of Statically Indeterminate Beams:** Theorem of three moments, Energy methods, Force method (Method of consistent deformation) [For analysis of propped cantilever, fixed beams and continuous beams (maximum two degree of indeterminacy) for simple loading case], Analysis of two hinged arch.	12
6	**Influence Line Diagram for Indeterminate Structures:** Muller – Breslau principle.	5

COURSE OUTCOMES (COs):

After going through this course, the students will be able to:

CO1. Distinguish between stable and unstable and statically determinate and indeterminate structures.
CO2. Apply equations of equilibrium to structures and compute the reactions.
CO3. Calculate the internal forces in cable and arch type structures.
CO4. Evaluate and draw the influence lines for reactions, shears and bending moments in beams due to moving loads.
CO5. Use approximate methods for analysis of statically indeterminate structures. Calculate the deflections of truss structures and beams.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.
PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.
PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping of Course Outcomes with Program Outcomes															
POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)503-CO1	3	1	-	-	-	1	1	-	2	-	1	2	1	1	3
CE(PC)503-CO2	3	2	2	-	-	1	1	-	2	1	-	2	1	1	3
CE(PC)503-CO3	3	2	1	1	-	1	1	2	2	-	-	2	1	1	3
CE(PC)503-CO4	3	2	1	-	1	1	1	-	2	-	1	2	1	1	3
CE(PC)503-CO5	3	2	-	-	-	1	1	-	2	1	1	2	1	1	3
AVG.	3	1.8	1.33	1	1	1	1	2	2	1	1	2	1	1	3

1: Slightly 2: Moderately 3: Substantially

Subject Code: **CE(PC)505**	Category: **Professional Core Courses**
Subject Name: **Environmental Engineering-II**	Semester: **V**
L-T-P: **2-1-0**	Credit: **3**

PREREQUISITE:

Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Engineering Mechanics, Fluid Mechanics and Hydraulics; Environmental Engineering – I [CE(PC)402]

COURSE OBJECTIVES:

Describing the physical, chemical, and biological processes necessary for designing and managing primary, secondary, tertiary and advanced wastewater treatment processes and solids handling systems. Exploring the concept of basic plumbing. Understanding the nature and types of hazardous waste.

COURSE CONTENT:

Module No	Description of Topic	Hours/ Week
1	**Sewage and Drainage:** Definition of Common Terms: Sewage or Sanitary Sewage, Drainage or Storm Sewage, Sullage, Black Water, Grey Water Sewerage Systems: Separate system, Combined System, Partially Separate System; applicability, advantages and disadvantages	2
2	**Sewage and Drainage Quantity:** Quantity estimation for sanitary sewage; Quantity estimation for storm sewage.	4
3	**Conveyance of Sewage: Sewers:** Shapes; Design parameters; Operation and maintenance of sewers; Sewer appurtenances **Hydraulic Design of Sewers:** Partial flow diagrams and Nomograms.	6
4	**Wastewater Characteristics:** Physical, chemical and biological characteristics of municipal and domestic sewage; Effluent discharge standards.	6
5	**Wastewater Treatment:** Primary, secondary and tertiary treatment of wastewater; aerobic an anaerobic treatment options **Primary and Secondary Treatment of Domestic Wastewater:** Typical Flow Chart of STP; Screen and Bar Racks; Grit Chamber; Primary and Secondary Sedimentation Tank; Activated Sludge Process; Trickling Filter	12
6	**Sludge Handling and Disposal:** Sludge Thickening; Sludge Digestion; Sludge Drying Bed	4
7	**Building Plumbing:** Introduction to various types of home plumbing systems for water supply and waste water disposal; high rise building plumbing; Pressure reducing valves; Break pressure tanks; Storage tanks; Building drainage for high rise buildings; various kinds of fixtures and fittings used	4
8	**Hazardous waste:** Types and nature of hazardous waste as per the HW Schedules of regulating authorities	4

COURSE OUTCOMES:

After going through this course, the students will be able to:

CO1. Define the basic concepts and terminologies of waste water engineering and hazardous waste management

CO2. Describe different home plumbing systems for water supply and wastewater disposal Apply the methods of quantifying sanitary sewage and storm sewage

CO3. Solve different mathematical problems regarding different components of sewerage system

CO4. Compare between different wastewater samples based on their physical, chemical and biological characteristics.

CO5. Design different unit processes and operations involved in wastewater treatment. Exploring the concept of basic plumbing. Understanding the nature and types of hazardous waste.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping of Course Outcomes with Program Outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)505-CO1	2	2	3	3	-	-	2	-	-	-	2	3	1	2	1
CE(PC)505-CO2	3	3	3	2	3	-	2	-	-	2	2	2	3	2	3
CE(PC)505-CO3	3	2	2	1	3	-	-	1	1	1	1	1	2	2	3
CE(PC)505-CO4	3	-	2	-	3	2	2	2	-	-	-	2	3	3	3
CE(PC)505-CO5	3	3	-	2	2	2	3	1	1	1	-	2	3	2	3
AVG.	2.8	2.5	2.5	2	2.75	2	2.25	1.33	1	1.33	1.67	2	2.4	2.2	2.6

1: Slightly 2: Moderately 3: Substantially

Subject Code: **CE(PC)595**	Category: **Professional Core Courses**
Subject Name: **Environmental Engineering Laboratory**	Semester: **V**
L-T-P: **0-0-2**	Credit: **1**

PREREQUISITE:

Class-XII level knowledge of Physics, Chemistry, Mathematics, Biology and Environmental Science; Undergraduate level knowledge of Environmental Engineering, Biology for Engineers, Chemistry Laboratory, Physics Laboratory

COURSE OBJECTIVES:

Experiment various physical, chemical and biological characteristics for a given sample of water. Compare the determined quality parameters with standards to decide on the suitability of use for the tested water and disposal of tested wastewater

COURSE CONTENT:

Module No	Description of Topic	Hours/ Week
1	Determination of turbidity for a given sample of water	2P
2	Determination of electrical conductivity for a given sample of water	2P
3	Determination of Total Solids, Suspended Solids, Dissolved Solids and Volatile Solids in a given sample of water	2P
4	Determination of pH for a given sample of water	2P
5	Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water	2P
6	Determination of acidity for a given sample of water	2P
7	Determination of hardness for a given sample of water	2P
8	Determination of concentration of Iron in a given sample of water	2P
9	Determination of concentration of Chlorides in a given sample of water	2P
10	Determination of the Optimum Alum Dose for a given sample of water through Jar Test	2P
11	Determination of the Chlorine Demand and Break-Point Chlorination for a given sample of water	2P
12	Determination of amount of Dissolved Oxygen (DO) in a given sample of water	2P
13	Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater	2P
14	Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater	2P
15	Determination of Colliform Bacteria: presumptive test, Confirmative test and Determination of MPN	2P

COURSE OUTCOMES (COs):

On completion of the course the students will be able to:

CO1. Experiment various physical characteristics for a given sample of water and wastewater
CO2. Determine various chemical characteristics for a given sample of water and wastewater
CO3. Examine the bacteriological characteristics for a given sample of water and wastewater
CO4. Examine the suitability of a few treatment options for a given sample of water and wastewater
CO5. Compare the determined quality parameters with standards to decide on the suitability of use for the tested water and disposal of tested wastewater

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.
PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.
PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping Of Course Outcomes with Program Outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)501-CO1	3	3	-	2	-	-	2	-	-	-	3	3	3	1	1
CE(PC)501-CO2	3	3	-	2	-	-	2	-	-	-	3	3	3	1	1
CE(PC)501-CO3	3	3	-	2	-	-	2	-	-	-	3	3	3	1	1
CE(PC)501-CO4	2	1	-	2	-	2	2	-	-	-	2	3	3	2	1
CE(PC)501-CO5	2	2	-	2	-	2	2	-	-	-	2	3	2	2	1
AVG.	2.6	2.4	-	2	-	2	2	-	-	-	2.6	3	2.8	1.4	1

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(PC)502	Category: Engineering Professional Course
Subject Name: ENGINEERING HYDROLOGY	Semester: V
L-T-P: 3+0+0	Credit: 3

Prerequisites: Introduction to Civil Engineering CE(HS)302, CE(ES)401_Fluid Mechanics, Chemistry BS-CH101,Physics BS-PH101

COURSE OBJECTIVE

1.To impart knowledge about the water resources and components of hydrological cycle.

2.To introduce the fundamental concepts relevant to water budget, watershed, runoff estimation, hydrograph analysis, flood and groundwater hydrology.

3.To enable the students to understand the factors responsible for different processes in hydrological cycle.

MODULE NO	DESCRIPTIONS OF TOPIC	CONTACT HOURS
Module 1	Hydrology: Hydrologic Cycle, Global Water Budget, India's Water Budget.	1
Module 2	Catchment: Definition & Descriptions, Various Types of Catchment, FactorsCharacterizing a Catchment, Delineation of Catchment Boundary.	2
Module 3:	Measurement of Precipitation: Precipitation, Description and Functioning ofVarious Types of Rain gauges, Rain gauge Network- Codal Provisions, Optimum Number of Rain gauge Stations.	2
Module 4:	Processing of Rainfall Data: Normal Rainfall, Estimation of Missing RainfallData, Test for Consistency of Record; Mass Curve of Rainfall, Hyetograph, Point Rainfall; Mean Precipitation over an Area– Arithmetic Mean, Thiessen Polygon and Iso hyetal Method .	4
Module 5:	Losses from Precipitation: Evaporation – Evaporation Process, Factors affectingEvaporation, Measurement of Evaporation– Description and Functioning of PanEvaporimeter, Pan Coefficient, Evapotranspiration: AET, PET, Measurement of ET, Estimation of ET– Blaney Criddle Formulae; Infiltration– Process, Factors Affecting	6

	Infiltration, Infiltration Rate and Infiltration Capacity, Measurement of Infiltration, Infiltration Equations, Infiltration Indices.	
Module 6	Streamflow Measurement: Importance, Direct and Indirect Methods, Measurement of Stage– Various Gauges and Recorders, Measurement of Velocity Current Meters, their Functioning and Calibration; Velocity Distribution, Floats; Streamflow Computation– Area Velocity Method, MovingBoat Method, Dilution Technique, Electromagnetic Method, Ultrasonic Method; Indirect Methods– Flow Measuring Structures, Slope Area Method; StageDischarge Relation, Permanent Control, Stage for Zero Discharge, ShiftingControl– Backwater Effect, Unsteady Flow Effect, Extension of the Rating Curve.	**12**
Module 7	Runoff: Description of the Process, Components of Runoff, Factors AffectingRunoff, Characteristics of Streams, Rainfall Runoff Relationships. Hydrographs: Types, Base Flow Separation, Effective Rainfall.	**2**
Module 8	Unit Hydrograph– Definition, Assumptions, Applications– Derivation of UnitHydrograph, Distribution Graph, Unit Hydrograph of Different Durations– Method of Superposition and S-Curve.	**4**
Module 9	Floods: Concept of flood as a natural hazard; Estimation of flood discharge in ariver – rational method, empirical formulae, unit hydrograph method; flood frequency studies – return period.	**2**

<u>Mapping of Course outcomes with Program outcomes</u>

CO-PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)502.1	3	1	-	-	-	-	-	-	-	-	-	-	3	2	1
: CE(PC)502.2	3	3	3	2	-	-	-	-	-	1	-	2	3	2	1
CE(PC)502. 3	3	3	3	-	2	1	1	-	-	2	-	2	3	2	1

CE(PC)502.4	3	3	2	-	2	1	1	-	-	-	1	-	2	2	1
Average	3	2.5	2.67	2	2	1	1	-	-	1.5	1	2	2.75	2.75	1

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE (PC) 594	Category: Professional Core Course
Subject Name: Soil mechanics Laboratory	Semester: V
L-T-P: 2+0+0	Credit: 1

Course Objective:

Application of theoretical and experimental procedure of soil mechanics is the primary objectives of this lab. This include: identifying site condition, evaluation of loose rocks as construction material, and describing and determining the mechanic features of the soils.

CE(PC)594	Soil Mechanics Laboratory	2P	1 Credits
Course Outcome	After going through this course, the students will be able to: 1. Identify different types of soil by visual inspection. 2. Determine natural moisture content and specific gravity of various types of soil. 3. Estimate in-situ density by core cutter method and sand replacement method. 4. Analyze grain size distribution and Atterberg limits for soil. 5. Perform laboratory tests to determine permeability and compaction characteristics of soil. 6. Determine shear strength parameters of soil by unconfined compression test and vane shear test. 7. Determine shear strength parameters of soil by direct shear test. 8. Perform triaxial test to determine shear strength parameters of soil. 9. Determine California Bearing Ratio (CBR) of soil. 10. Prepare technical laboratory report		
Prerequisite	Soil Mechanics – I (CE(PC)401) and Soil Mechanics – II (CE(PC)504)		
Experiment 1	Field identification of different types of soil as per Indian Standards [collection of field samples and identifications without laboratory testing].		
Experiment 2	Determination of natural moisture content.		
Experiment 3	Determination of specific gravity of cohesionless and cohesive soils.		
Experiment 4	Determination of in-situ density by core cutter method and sand replacement method.		
Experiment 5	Determination of grain size distribution by sieve and hydrometer analysis.		
Experiment 6	Determination of Atterberg limits (liquid limit, plastic limit and shrinkage limit).		
Experiment 7	Determination of co-efficient of permeability by constant and variable head permeability tests.		
Experiment 8	Determination of compaction characteristics of soil by standard proctor compaction test.		
Experiment 9	Determination of unconfined compressive strength of soil by unconfined compression test.		
Experiment 10	Determination of shear strength parameters of soil by direct shear test.		
Experiment 11	Determination of undrained shear strength of soil by vane shear test.		
Experiment 12	Determination of shear strength parameters of soil by unconsolidated undrained triaxial test.		
Experiment 13	Determination of California Bearing Ratio (CBR) of soil.		
Experiment 14	Determination of relative density of soil.		
Experiment 15	Standard Penetration Test.		
Reference	**1.** Soil Mechanics Laboratory Manual by Braja Mohan Das (Oxford university press). **2.** SP: 36 (Part - I and Part - II)		

Course Outcomes (COs)

After going through this Course, the students will be able to:

CO1. Identify different types of soil by visual inspection and determination of natural moisture content and specific gravity of various types of soil.

CO2. Estimate in-situ density by core-cutter method and sand replacement method and grain-size analysis of soil and Atterberg limits determination for soil.

CO3. Perform laboratory test to determine permeability and compaction characteristics of soil.

CO4. Determine shear strength parameter of soil by unconfined compression test, vane shear test, direct shear test and triaxial test.

CO5. Determination of California Bearing Ratio (CBR) of soil and relative density of soil.

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes / Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE (PC) 594.CO 1	3	-	-	-	-	-	-	-	-	-	-	-	3	2	-
CE (PC) 594.CO 2	3	-	-	2	3	-	-	-	-	-	-	-	3	2	-
CE (PC) 594.CO 3	3	1	-	2	3	-	-	-	-	-	-	-	3	2	-
CE (PC) 594.CO 4	3	2	-	2	3	-	-	-	-	-	-	-	3	2	-
CE (PC) 594.CO 5	3	2	-	2	3	-	-	-	-	-	-	-	3	2	-
Avg.	3	1.67		2	3								3	2	-

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(PC)504	Category: Professional Core course
Subject Name: Soil Mechanics – II	Semester: V
L-T-P: 2+1+0	Credit: 3

Course Objective:

1. Students will learn how to utilize their knowledge in soil mechanics to perform various types of engineering calculations. This includes geotechnical design of foundation, settlement analysis, retaining walls, and slopes. etc.

Module No.	Description of topics	Contact hrs.
Module 1	**Consolidation of Soil** Terzaghi's theory of one dimensional consolidation, Compressibility characteristics of soils, Compression index, Coefficient of compressibility and volume change, Coefficient of consolidation, Degree and rate of consolidation, Time factor, Settlement computation, Consolidometer and laboratory one dimensional consolidation test as per latest IS Code, Determination of consolidation parameters.	8
Module 2	**Compaction of Soil** Principles of compaction, Standard and modified proctor compaction test, Field compaction methods, Field compaction control, Factors affecting compaction, Effect of compaction on soil properties.	4
Module 3	**Earth Pressure Theories** Plastic equilibrium of soil, Earth pressure at rest, Active and passive earth pressures, Rankine's and Coulomb's earth pressure theories, Different types of backfill, Wedge method of analysis. Analytical and graphical methods for determination of earth pressure against various earth retaining structures. **Stability of retaining walls:** Cantilever retaining wall.	10
Module 4	**Bearing capacity of shallow foundations** Bearing capacity, Definition, Factors affecting bearing capacity, Modes of failures, Methods of determining bearing capacity of soils. Terzaghi's bearing capacity theory, Effect of depth of embedment, Eccentricity of load, Foundation shape on bearing capacity, Effect of 11 water table and eccentric loads. Isolated footings with combined action of loads and moments, Bearing capacity as per IS: 6403.	11
Module 5	**Settlement** Allowable bearing pressure and settlement analysis (as per IS: 8009), Immediate and consolidation settlements, Rigidity and depth factor corrections, Settlement values as per IS: 1904 recommendations.	3
Module 6	**Stability of slopes** Types of failure, Analysis of finite and infinite slopes, Swedish and friction circle method, Ordinary method of slices, Factor of safety, Taylor's stability number, Bishop's simplified method of stability analysis.	5

Course Outcomes:

After going through this course, the students will be able to:

1. Assess the compaction and consolidation characteristics of soil for solving geotechnical problems.
2. Calculate earth pressure on rigid retaining walls on the basis of classical earth pressure theories.
3. Analyze and design rigid retaining walls (cantilever types) from geotechnical engineering consideration.
4. Evaluate the bearing capacity of shallow foundation by applying established theory.
5. Estimate settlement in soils by different methods.

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes → / Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-
CO 2	3	3	2	2	-	-	-	-	-	-	-	-	3	-	-
CO 3	3	3	2	1	-	-	-	-	-	-	-	-	3	1	-
CO 4	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
CO 5	3	3	1	2	-	-	-	-	-	-	-	-	3	2	-
Avg.	3	2.8	1.6	1.75									3	1.67	

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: **CE(PC)602**	Category: **Professional Core Course**
Subject Name: **Engineering Economics, Estimation & Costing**	Semester: **VI**
L-T-P: **2 – 0 - 0**	Credit: **2**

PREREQUISITE:

Introduction to Civil Engineering [CE(HS)302], Construction Engineering & Management [CE(PC)601]

COURSE OBJECTIVE

To expose the students to quantity surveying, BBS, analysis and schedule of rates and valuation along with the knowledge of specification of materials and works.

MODULE NO.	DESCRIPTIONS OF TOPIC	Contact Hours
MODULE 1	**Basic Principles and Methodology of Economics:** Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes	3H
MODULE 2	**Elements of Business/Managerial Economics and forms of organizations:** Cost & Cost Control – Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.	3H
MODULE 3	**Estimation / Measurements for various items:** Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying	9H
MODULE 4	**Specifications:** Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.	3H

MODULE 5	**Rate analysis:** Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.	3H
MODULE 6	**Tender:** Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management	3H
MODULE 7	**Valuation:** Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table	3H
MODULE 8	**Introduction to Acts pertaining to:** Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.	2H

Course Outcomes (COs):

The subject aims to provide the student with:

CO1. Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses

CO2. Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives and be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives

CO3. Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure

CO4. Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure

CO5. Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CE(PC)602. 1	3	-	-	-	-	-	-	3	-	-	-	-	2	1	1
CE(PC)602. 2	3	3	-	-	-	-	-	2	-	-	-	-	3	2	2
CE(PC)602. 3	3	-	-	-	-	-	-	2	-	-	-	-	-	2	2
CE(PC)602. 4	3	3	-	-	-	-	-	2	-	-	-	-	3	2	2
CE(PC)602. 5	3	1	-	-	-	-	-	2	-	-	-	-	3	2	2
Average	**3**	**2.33**	**-**	**-**	**-**	**-**	**-**	**2.2**	**-**	**-**	**-**	**-**	**2.75**	**1.8**	**1.8**

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of English

Course Code : CE (OE) 601 A	**Category :** Humanities Courses
Course Title : Soft Skills and Interpersonal Communications	**Semester** : Sixth
L-T-P : **3-1-0**	**Credit:3**

COURSE OBJECTIVE :

To help students develop basic proficiency in professional communication, including English Grammar, Vocabulary and Composition, and writing skills.
To help students develop their skills in the English language through literary and non-literary expression through fictional prose, poetry and drama.
To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs, reports and emails.
To help students develop their respective personalities,values, ethics and attitudes, suitable enough for dealing with others in professional set ups.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Communication Skill Definition, nature & attributes of Communication Process of Communication Models or Theories of Communication Types of Communication Levels or Channels of Communication Barriers to Communication	3L
2	Business Communication- Scope & Importance Writing Formal Business Letters Writing Reports Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular Project Proposal Technical Report Writing Organizing e-mail messages E-mail etiquette Tips for e-mail effectiveness	8L
3	Language through Literature Modes of literary & non-literary expression Introduction to Fiction, (An Astrologer's Day by R.K. Narayan and Monkey's Paw by W.W. Jacobs), Drama (The Two Executioners by Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of the Scorpion by Nissim Ezekiel and Palanquin Bearer by Sarojini Naidu	8L
4	Grammar in usage (nouns, verbs, adjectives, adverbs, tense, prepositions, voice change) - to be dealt with the help of the given texts.	10L

Course Outcome

1. Analyse the dynamics of business communication and communicate accordingly.

2. Write business letters and reports

3. Learn to articulate opinions and views with clarity and communicate in an official and formal environment.

4. Appreciate the use of language to create beautiful expressions

5. Analyse and appreciate literature.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(OE)601A.CO1	-	2	-	2	-	1	-	2	1	3	1	3
CE(OE)601A.CO2	-	-	1	1	-	1	-	2	-	3	-	3
CE(OE)601A.CO3	-	2	2	2	-	2	1	3	3	3	2	3
CE(OE)601A.CO.4	-	2	1	-	-	-	1	3	2	3	-	3
CE(OE)601A.CO.5	-	1	1	1	-	1	1	3	1	3	1	3
Average:	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Department of Civil Engineering

Subject Code: CE(PC)601	Category: Engineering Professional Course
Subject Name: CONSTRUCTION ENGINEERING AND MANAGEMENT	Semester: VI
L-T-P: 2+0+0	Credit: 2

Prerequisites : Introduction to Civil Engineering, Building Construction & Concrete Technology

COURSE OBJECTIVE

Students will gain knowledge on planning :

- The objective of this course is to know the basics of construction management.
- To understand the concepts of construction planning and scheduling.
- To understand the concepts of machinery and equipment management.
- To understand the various steps involved in tender and contract process.

Module No	Description of Topic	Contact Hours
Module 1	Planning: General consideration, Definition of aspect, prospect, roominess, grouping, circulation, Privacy.	2
Module 2	Regulation and Bye laws: Bye Laws in respect of side space, Back and front space, Covered areas, height ofbuilding etc., Lavatory blocks, ventilation, Requirements for stairs, lifts in public assembly building, offices	4
Module 3:	Fire Protection: Fire fighting arrangements in public assembly buildings, Planning, offices, and auditorium	2
Module 4:	Planning &Scheduling of constructions Projects Planning by CPM Preparation of network, Determination of slacks or floats. Critical activities. Critical path. Project duration. Planning by PERT Expected mean time, probability of completion of project, Estimation of critical path, problems	6
Module 5	Construction Methods basics : Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction	4

	methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.	
Module 6	Construction plants & Equipment Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses. Plants &Equipment for concrete construction Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control.	3
Module 7	Contracts Management basics Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.	4
Module 8	Management Professional practice, Definition, Rights and responsibilities of owner, engineer, Contractors, types of contracts	3
Module 9	Departmental Procedures Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbitration	2

Course outcome:

CO1- An idea of how structures are built and projects are developed on the field. The understanding & to determine the quantity of buildings require the knowledge of drawings. This knowledge will be useful to the student to prepare the construction schedule. They should also able to present the knowledge in a way that it is understandable by others. Explain Building By laws.

CO2- An understanding of modern construction practices. The Construction check lists is closely associated with the knowledge of Construction materials and engineering laboratory tests for different types of works etc. The student will able to analyses critical path, and resource allocation, towards the end of the course. A basic ability to plan, control and monitor construction projects with respect to time and cost.

CO3- Understand the various equipment related to earth moving, drilling and blasting, pile driving, pumping, stone crushing, air compressors, equipment for moving materials etc. Understand the different types of standard/special equipment used in the construction industry and learn the different sources of equipment, economic life and depreciation cost of equipment.

CO4- A good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics. The students should have the knowledge to quality control monitoring in the project, project safety management and construction project information

CO5- An idea how construction projects are administered with respect to contract structures and issues. An idea of how to optimise construction projects based on costs

PROGRAM SPECIFIC OUTCOMES (PSOs) The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: Able to understand the necessity of Civil Engineering solutions in a economical, Environmental and societal context.

Mapping of Course outcomes with Program outcomes

CO-PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)601.1	-	-	-	-	3	-	-	-	-	3	3	-	-	3	1
CE(PC)601.2	-	-	-	-	-	-	-	-	-	3	3	-	-	2	1
CE(PC)601.3	-	-	-	-	-	-	-	-	-	3	3	-	-	3	1
CE(PC)601.4	-	-	-	-	-	-	-	-	-	3	3	-	-	3	1
CE(PC)601.5	-	-	-	-	-	-	-	-	-	3	3	-	2	-	-
Average	-	-	-	-	3	-	-	-	-	3	3	-	2	2.75	1

1: Slightly 2: Moderately 3: Substantially

<u>OmDayal Group of Institutions</u>

Department of Civil Engineering

Subject Code: CE(PC)603	Category: Engineering Professional Course
Subject Name: WATER RESOURCE ENGINEERING	Semester: VI
L-T-P: 2+0+0	Credit: 2

Prerequisites : Physics, Mathematics, Introduction to Civil Engineering & Engineering Hydrology and Introduction to Fluid Mechanics CE(ES)401

<u>COURSE OBJECTIVE</u>

1. To impart knowledge about the water resources and components of hydrological cycle.
2. To introduce the fundamental concepts relevant to flow in open channels, GVF, RVF, energy dissipation, soil moisture, irrigation requirement, canals and water resources management.
3. To enable the students to understand the factors responsible for different processes in open channel hydraulics and irrigation sciences.

MODULE NO.	DESCRIPTIONS OF ITEMS	CONTACT HOURS
Module 1	Open Channel Flow: Channel Characteristics and parameters, Energy-depth relationships, Specific Energy concept, Critical Flow, Hydraulic Jump, Uniform flow, Efficient sections, Slope profiles, Gradually Varied Flow, Water surface profiles.	**8**
Module 2	Irrigation: Definition, Necessity, Scope, Benefits of Irrigation; Types, techniques and sources of irrigation; Development of irrigation in India.	**3**
Module 3	Soil-water plant Relationship: Types of crops, cropping seasons, water requirement of crops, base period, kor period, Duty, Delta, Commanded area, Net Irrigation Requirement, Field Irrigation Requirement, Gross Irrigation Requirement, Intensity of irrigation, Consumptive use of water, estimation of evapotranspiration, Blaney Criddle method, Modified Penman’s method, Irrigation efficiencies, Frequency of irrigation.	**6**
Module 4:	Canal irrigation: Classification of irrigation canals, canals in alluvium; Design of unlined canals: Kennedy's method, Lacey's method; Lined canals: advantages, materials used, typical sections, design of lined canals, economics of canal lining; Canal sections –filling, cutting, partial cutting and partial filling.	**6**
Module 5	Land drainage: Water logging issues in irrigation, provision of drains, design and maintenance of open drains, closed drains, discharge and spacing of closed drains.	**4**

MODULE NO.	DESCRIPTIONS OF ITEMS	CONTACT HOURS
Module 6	Groundwater: Occurrence of groundwater– Aquifers, Various Types of Aquifers, Aquifer Parameters: Specific Yield, Specific Retention, Storage Coefficient, Transmissivity.	**4**

Course Outcomes (COs):

At the end of the course, students would be able to -----

CO1: Understand the concepts of irrigation. To describe the basic principles and design parameters of the irrigation. Explain the application of water in different irrigation methods.

CO2- Understand the fundamentals of flow in open channels To select the appropriate method for irrigation network based on specific field

CO3- Estimate the quantity of water required by different crops in different seasons, and accordingly the irrigation water requirement Collect data and calculate the demand of water for agricultural land.

CO4- Design channels and other irrigation structures required for irrigation, drainage, soil conservation, flood control and other water-management projects. To design the hydraulic structures like canals. To detect the water logged area due to over irrigation

CO5- Learn about groundwater resources, aquifers and wells.

PROGRAM SPECIFIC OUTCOMES (PSOs) : The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: Able to understand the necessity of Civil Engineering solutions in a economical, Environmental and societal context.

Mapping of Course outcomes with Program outcomes

CO-PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC) 603.1	2	2	1	1	-	1	1	-	1	-	-	1	1	1	1
CE(PC) 603.2	3	2	2	2	-	2	1	-	1	-	-	-	3	2	1

CE(PC) 603.3	-	-	-	-	2	1	1	-	-	-	1	-	3	2	1
CE(PC) 603.4	-	-	-	-	2	1	1	-	-	-	1	-	3	2	1
CE(PC) 603.5	-	-	-	-	-	1	1	-	-	-	1	-	3	2	1
AVERAGE	2.5	2	1.5	1.5	2	1.2	1	-	1	-	1	1	2.6	1.8	1

1: Slightly 2: Moderately 3: Substantially

<u>OmDayal Group of Institutions</u>

Department of Civil Engineering

Subject Code: CE(PC)695	Category: Professional Core Courses
Subject Name: Quantity Survey Estimation and Valuation Sessional	Semester: VI
L-T-P: 0+1+2	Credit: 2

Prerequisites: Introduction to Civil Engineering [CE(HS)302], Construction Engineering & Management [CE(PC)601], Engineering Economics, Estimation & Costing [CE(PC)602]

Course Objectives:

The objective of this course is to give the students basics knowledge of estimating and valuation of civil engineering works. After completing this course the students will also be able to analyze the rates and estimate the various construction works

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Quantity Surveying: Types of estimates, approximate estimates, items of work, unit of measurement, unit rate of payment.	2
2	Quantity estimate of a single storied building	2
3	Bar bending schedule.	2
4	Details of measurement and calculation of quantities with cost, bill of quantities, abstract of quantities.	2
5	Estimate of quantities of road, Underground reservoir, Surface drain, Septic tank.	4
6	Analysis and schedule of rates: Earthwork, brick flat soling, DPC, PCC and RCC, brick work, plastering, flooring and finishing,	3
7	Specification of materials: Brick, cement, fine and coarse aggregates	2
8	Specification of works: Plain cement concrete, reinforced cement concrete, first class brickwork, cement plastering,	3

	pointing, white washing, colour washing, distempering, lime punning, painting and varnishing	
9	Valuation: Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table	4

Course Outcomes:

After completing the course the student will be able to

1. An introduction to quantity surveying
2. The capability to know analysis and schedule of rates
3. The ability to know specification of materials
4. An understanding about specification of works
5. The introduction to valuation

PROGRAM SPECIFIC OUTCOMES (PSOs) The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes → / ↓ **Course outcome**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PC)695.1	3	2	2	1	2	1	-	1	-	1	-	1	3	1	-
CE(PC)695.2	2	2	1	1	2	-	-	1	-	1	-	1	2	1	-
CE(PC)695.3	-	-	1	-	-	1	1	1	-	-	-	1	-	1	-
CE(PC)695.4	2	-	-	-	-	-	-	-	-	-	-	1	2	-	-
CE(PC)695.5	2	-	-	-	-	-	-	1	-	-	1	1	2	1	1
Average	2.3	2.0	1.3	1.0	2.0	1.0	1.0	1.0	-	1.0	1.0	1.0	2.3	1.0	1.0

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(PE)601B	Category: Professional Elective course
Subject Name: Foundation Engineering	Semester: VI
L-T-P: 2+0+0	Credit: 2

Course Objective:

The goal of this course is to teach the students how to apply the soil mechanics principles and engineering behaviour of soils, that they have learned in Soil Mechanics course, to the foundation engineering with new topics on design of deep foundations.

Module No.	Description of Topics	Contact Hrs.
Module 1	**Introduction** Classification, selection- shallow and deep foundations.	2
Module 2	**Deep foundations** Pile foundation: Types of piles, material, Suitability and uses, Method of installation of piles - classification of piles based on material, Installation Techniques – Selection and uses, Determination of types and lengths of piles, Load transfer mechanism, Determination of load carrying capacities of piles by static and dynamic formulae as per IS codes, Pile spacing and group action, Group efficiency, Negative skin friction, Pile load test, Settlement of pile group, Lateral load capacity of pile by IS: 2911 and Reese & Matlock methods, Uplift capacity of pile - introduction.	9
Module 3:	**Site Investigation & Soil Exploration** Planning of sub-surface exploration, Methods of boring, sampling, Different types of samples, Spacing, Depth and number of exploratory borings, Bore log, Preparation of sub-soil investigation report. **In-situ tests** Standard penetration test, Static cone penetration test, Dynamic cone penetration test, Field vane shear test, Plate load test. **Indirect methods of soil exploration** Geophysical method: seismic refraction and electrical resistivity methods.	6
Module 4:	**Shallow Foundations** Bearing Capacity from SPT, SCPT and Plate load Test data.	3
Module 5:	**Sheet pile structures** Type of sheet pilling, Design of sheet pile, Cantilever sheet piling, Anchored sheet piling, Free earth and fixed earth support methods, Analysis with anchored bulk	4

	heads.	
Module 6	**Introduction to Ground Improvement Techniques** Introduction, Economic considerations, Consolidation by preloading and sand	6

Course Outcomes:

On successful completion of this course, student should be able to:

1. Determine the load carrying capacity of pile foundation.
2. Compute the efficiency and settlement of pile group.
3. Understand different subsoil exploration methods and interpret field and laboratory test data to obtain design parameters for geotechnical analysis.
4. Correlate bearing capacity of shallow foundation from field test data.
5. Analyze and design sheet pile structure on the basis of earth pressure theories. Understand and apply various types of ground improvement methods for solving complex geotechnical problems.

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes → / Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PE)601B. CO 1	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CE(PE)601B. CO 2	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CE(PE)601B. CO 3	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-
CE(PE)601B. CO 4	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CE(PE)601B. CO 5	3	3	3	-	-	-	-	-	-	-	-	-	3	2	-
Avg.	3	2.6	2.25	2	2								3	2	

1: Slightly 2: Moderately 3: Substantially

Subject Code: CE(PC)604	**Category:** Professional Core Courses
Subject Name: Design of Steel Structure	**Semester:** VI
L-T-P: 2-0-0	**Credit:** 2

Prerequisite: Introduction to Solid Mechanics (CE(ES)402)

Course Objectives:

Students will be able to analyse the behaviour of steel structure under different type of loading. To design a connection using IS:800-2007 and satisfy the serviceability and strength parameters. To acquire the knowledge to design tension, compression, member's columns, beams. Using the codal Stipulation and basic knowledge of structural analysis students will be able to design plate girders and gantry girders considering lateral buckling.

Course Content:

Module No	Description of Topic	Hours/ Week
1	Materials and Specification: Rolled steel sections, mechanical properties of steel and their specifications for structural use. Codes of practices. Design of Steel structures using tubular, rectangular and square section	1
2	Structural connections: Riveted, welded and bolted including High strength friction grip bolted joints. – types of riveted & bolted joints, assumptions, failure of joints ,efficiency of joints, design of bolted ,riveted & welded joints for axial load. Eccentric connection:- Riveted & bolted joints subjected to torsion & shear, tension & shear, design of riveted, bolted & welded connection.	6
3	Design of Tension members: Design of tension members, I.S code provisions. Permissible stresses, Design rules, Examples.	3
4	Design of Compression members: Effective lengths about major & minor principal axes, I.S code provisions. Permissible stresses, Design rules, Design of one component, two components and built up compression members under axial load. Examples. Built up columns under eccentric loading: Design of lacing and batten plates, Different types of Column Bases-Slab Base , Gusseted Base, Connection details	6
5	Design of Beams: Permissible stresses in bending, compression and tension. Design of rolled steel sections, plated beams, Simple Beam end connections, beam -Column connections. I.S code provisions	4
6	Design of Plate girders: Design of webs & flanges, Concepts of curtailment of flanges – Riveted & welded web stiffeners, web flange splices - Riveted, welded& bolted.	4
7	Design of Gantry Girder: Design gantry girder considering lateral buckling – I.S code provisions.	4

Course Outcomes:

After going through this course, the students will be able to:

1. Identify the material properties of structural steel. Moreover, the students will identify different bolted and welded connections, analyse and design them for axial and eccentric loads.
2. Design different steel sections subjected to axial compression and tension following Indian codes of practices. Comprehend the differences between laterally supported and unsupported flexure members. Designing of the flexure members using Indian codes of practice.
3. Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension.
4. Calculate shear force and bending moment on rolled and built up girders, dimension the section and finally design it following Indian standard design guidelines.
5. Identify different components of gantry system, calculate lateral and vertical loads acting on the system, dimension the components and design them. Design different components of an industrial building.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping of Course outcomes with Program outcomes															
POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1			2	2	1			2	3	1	1	3
CO2	3	3	2	2	1		1	2			1	3	3	3	2
CO3	2	2		2			3	3				3	3	2	2
CO4	2	1	3		3	2			3	2	2	3	1	2	1
CO5	3		2	2	3				2		1	3	3	2	2
	2.6	2	2	2	2	2	2	2	2	2	1.5	3	2.2	1	2

1: Slightly 2: Moderately 3: Substantially

Subject Code: **CE (PC) 693**	Category: **Professional Core Courses**
Subject Name: **Water Resource Engineering Laboratory**	Semester: **VI**
L-T-P: **0-0-2**	Credit: **1**

Pre-requisites: Engineering Hydrology [CE (PC) 502], Water Resource Engineering [CE(PC)603]

Course Objective:

To impart knowledge about the water resources and its components by doing different experiments to know the average rainfall over a catchment, use of rain gauge, measurement of infiltration, measure the sunshine hours of a particular day etc.

Course Content:

Experiment No	Description of Topic	Hours/ Week
1	Catchment area delineation (Manually and using DEM)	2P
2	Calculation of average rainfall over a catchment area with arithmetic mean method, Thiessen polygon method and Isohyetal Method.	
3	Use of different type of Rain gauges.	
4	Measurement of infiltration rate using double ring infiltrometer.	
5	Measurement of evaporation using evaporimeter.	
6	Measurement of bright sunshine hours using sunshine recorder.	

Course Outcomes (COs)

After going through this Course, the students will be able to:

CO 1. Delineate the watershed of any reservoir using DEM.

CO 2. Determine the average rainfall over a catchment.

CO 3. Use the rain gauge properly for a specified purpose.

CO 4. Measure the rate of infiltration of water through the soil.

CO 5. Measure the sunshine hours in a particular day.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping Of Course Outcomes with Program Outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	2	-	-	2	-	-	-	3	3	3	1	1
2	3	3	-	2	-	-	2	-	-	-	3	3	3	1	1
3	3	3	-	2	-	-	2	-	-	-	3	3	3	1	1
4	2	1	-	2	-	2	2	-	-	-	2	3	3	2	1
5	2	2	-	2	-	2	2	-	-	-	2	3	2	2	1
AVG.	2.6	2.4	-	2	-	2	2	-	-	-	2.6	3	2.8	1.4	1

1: Slightly 2: Moderately 3: Substantially

Subject Code: **CE (PC) 694**	Category: **Professional Core Courses**
Subject Name: **Steel Structure Design Sessional**	Semester: **VI**
L-T-P: **0-0-2**	Credit: **1**

Pre-requisites: Design of Steel Structures (CE(PC)604

Course Objective:

To impart knowledge about the water resources and its components by doing different experiments to know the average rainfall over a catchment, use of rain gauge, measurement of infiltration, measure the sunshine hours of a particular day etc.

Course Content:

Description of Topic	Hours/Week
Design of a factory shed including preparation of necessary working drawings and report in accordance with CE(PC)604	2P

Course Outcomes (COs)

After going through this Course, the students will be able to:

1. Identify the material properties of structural steel. Moreover, the students will identify different bolted and welded connections, analyse and design them for axial and eccentric loads. Design different steel sections subjected to axial compression and tension following Indian codes of practices.
2. Comprehend the differences between laterally supported and unsupported flexure members. Designing of the flexure members using Indian codes of practice.
3. Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension.
4. Calculate shear force and bending moment on rolled and built up girders, dimension the section and finally design it following Indian standard design guidelines.
5. Identify different components of gantry system, calculate lateral and vertical loads acting on the system, dimension the components and design them. Design different components of an industrial building.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping Of Course Outcomes with Program Outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3							1					3	3	
CO2	3	2		1				1					3	3	
CO3	3	1		1				1					3	3	
CO4	3	3	2	1				1					3	3	
CO5	3	2						1					3	3	
AVG.	3	2	2	1				1					3	3	

1: Slightly 2: Moderately 3: Substantially

Subject Code: CE(PE)602B	**Category:** Professional Elective Courses
Subject Name: Structural Analysis-II	**Semester:** VI
L-T-P: 2-0-0	**Credit:** 2

Prerequisite: Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503)

Course Objectives:

Students will understand Slope Deflection and Moment Distribution Method to analyze indeterminate structures. Develop and analyze Curved Beam, Suspension bridge and Stiffness girder. Develop and analyze the portal frames using Portal and Cantilever method. Develop and analyze the indeterminate structures (continuous beams and frames) using flexibility and stiffness matrix method.

Course Content:

Module No	Description of Topic	Hours/ Week
1	**Analysis of statically Indeterminate Structures:** Moment distribution method-solution of continuous beam, effect of settlement and rotation of support, frames with or without side sway. Slope deflection method: method and application in continuous beams and frames. Suspension Bridge and stiffening girders.	8
2	**Curved Beam analysis:** Hooks, rings and Bow girders. Unsymmetrical bending.	8
3	**Plastic analysis of structures:** beams and portal frames.	5
4	**Approximate method of analysis of structures:** Portal and Cantilever methods.	4
5	Matrix methods of structural analysis – Stiffness and flexibility approaches for analysis of beam.	5

Course Outcomes:

After going through this course, the students will be able to:

1. Apply the Slope Deflection and Moment Distribution Method to analyze indeterminate structures.
2. Develop and analyze the concept of suspension bridge and stiffness girders
3. Apply and analyze the concepts of curved beam analysis in hooks, rings and Bow girders. Develop the concept bending in unsymmetrical beams.
4. Develop the fundamental concepts of plastic analysis using kinematic method and apply them in frames and continuous beam analysis.
5. Develop and analyze the portal frames using Portal and Cantilever method. Develop and analyze the indeterminate structures (continuous beams and frames) using flexibility and stiffness matrix method.

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping of Course outcomes with Program outcomes															
POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		2		1	1		2		2	3	1	2	3
CO2	3	2			2	1	1	1	2			2	3	2	3
CO3	3	2	1	1		1	1		2	1	2	2	1	2	2
CO4	3	2				1	1		2			2	2	2	3
CO5	3	2	1			1	1		2	1		3	1	1	2
	3	2	1	1.5	2	1	1	1	2	1	2	2.4	1.6	1.8	2.6

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: **CE(PROJ)792**	Category: **Project**
Subject Name: **Project-1 (Project Work)**	Semester: **VII**
L-T-P: **0 – 0 - 10**	Credit: **5**

PREREQUISITE:

Designing and detailing of R.C.C Structures & Steel Structures , Foundation Engineering, Transportation Engineering

COURSE OBJECTIVE

To expose the students to project work on typical Civil Engineering Problem.

Course Outcomes (COs):

At the end of the course, the student will be able to

CO1. Understand basic concept of R.C.C/ Steel Structures/ Traffic and Transportation Engineering/ Soil Mechanics.

CO2. Conceptualize various research works in the field of engineering

CO3. Analysis of different elements/ parameters of engineering

CO4. Design various members/ parameter of the structure /specific engineering problems

CO5. Submit detailed report on the project including detailing/ studied results of structures/ experiments/ real time collected data

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CE(PROJ)792. 1	3	1	-	-	-	-	2	-	-	-	-	-	3	-	1
CE(PROJ)792. 2	3	3	-	3	-	2	-	-	3	-	1	3	3	-	1
CE(PROJ)792. 3	3	3	2	3	3	2	2	3	3	2	1	3	3	3	2
CE(PROJ)792. 4	3	3	3	3	3	2	2	3	3	2	1	3	3	3	2
CE(PROJ)792. 5	3	3	3	3	3	2	2	3	3	3	-	-	3	3	2
Average	**3**	**2.6**	**2.67**	**3**	**3**	**2**	**2**	**3**	**3**	**2.33**	**1**	**3**	**3**	**3**	**1.6**

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(OE)701A	Category: Engineering Optional Elective Course
Subject Name: Metro System and Engineering	Semester: VII
L-T-P: 2+0+0	Credit: 2

Pre-requisites: Basic Science, Introduction to Civil Engineering, Surveying, Transportation Engineering.The objective of this course is appreciate of the need for lifelong learning through the discussion of recent changes and studies of highway and transportation engineering, also have the ability to apply knowledge of mathematics, science, and engineering to understand the design techniques and equipment used in highway engineering.

COURSE OBJECTIVE

Impart knowledge of metro construction

1. Build facts related to metro development in India and at global level.
2. Understand the alignments and land utilizations for mass transport development
3. Identify the signal arrangement and its functions for the smooth operations of Metro
4. Impart the construction techniques of at grade and grade separators geometrical features

MODULE NO	DESCRIPTIONS TOPIC	CONTACT HOURS
Module 1	Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financial	4
Module 2	CIVIL ENGINEERING Overview and construction methods for: Elevated and undergroundStations; Viaduct spans and bridges; Underground tunnels ; Depots; Commercialand Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Trafficintegration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems permanent way.	12

	Facilities Management	
Module 3:	ELECTRONICS AND COMMUNICATION ENGINEERING Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.	5
Module 4:	MECHANICAL & TV + AC Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators	5
Module 5:	ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics ;	5

Course Outcomes (COs):

At the end of the course, the student will be able to:
CO 1. Plan and prioritize Mass rapid Transit System networks with consideration of finance and socio-economic condition.
CO 2. Design of Mass Rapid transit System, rolling stock and understand Ventilation System.
CO 3. Design Signalling & Telecommunication system for Metro Rail.
CO 4. Design of Elevated structures –Viaducts and Underground Structures- Tunnels.

PROGRAM SPECIFIC OUTCOMES (PSOs) :The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: Able to understand the necessity of Civil Engineering solutions in a economical, Environmental and societal context.

Mapping of Course outcomes with Program outcomes

CO-PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CE(OE)701A.1	3	3	2	-	-	2	-	-	-	-	3	-	3	3	3
CE(OE)701A.2	3	3	2	-	2	-	-	-	-	-	-	-	3	2	2
CE(OE)701A. 3	3	3	3	-	1	1	-	-	-	-	-	-	3	1	1
CE(OE)701A.4	3	3	2	2	2	-	-	-	-	-	-	-	3	1	1
Average	3	3	2.25	2	1.67	1.5	-	-	-	-	3	-	3	1.75	1.75

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(PE)703A	Category: Professional Elective course
Subject Name: Air and Noise Pollution and Control	Semester: VII
L-T-P: 2+1+0	Credit: 3

Course Objective:

1) To know a Effects of Noise Pollution in India. 2) To examine ways to control Noise Pollution. 3) To provide preventive and control measures on noise generated within our environment

Module No.	Description of Topics	Contact Hrs.
Module 1	**Air Pollutants** Sources; Classification; Effects on Human, Vegetation, Material Effects of Air pollution on Atmosphere: Photochemical Smog, Ozone Layer Depletion, Acid Rain, Greenhouse Effect and Global Warming	6
Module 2	**Air Pollution Meteorology** Lapse Rate; Atmospheric Stability; Inversion; Plume Pattern	4
Module 3	**Dispersion of Air Pollutants** Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height	4
Module 4	**Air Quality** Methods of Measurement: Gaseous pollutants, Particulate pollutants Air Quality Standards and Indices: Ambient Air Quality Standard, NAAQS, Emission Standard, Air Quality Indices	6
Module 5	**Air Pollution Control** Control of Gaseous Pollutants: Adsorption, Absorption, Condensation Control of Particulate Pollutants: Settling chambers, Cyclone separators, Wet collectors, Fabric filters, Electrostatic precipitators Control of Pollution from Automobiles	8
Module 6	**Physics of Noise** Basics of Acoustics; Sound Pressure, Power and Intensity and their Interrelations	2
Module 7	**Measurement of Noise** Noise Level; Interrelation between Noise, Pressure, Power and Intensity Levels; Noise Meter; Noise	6

	Networks; Frequency Band Analysis; Decibel Addition Measurement of Community Noise: LN, Leq, Ldn,, LNP	
Module 8	**Source and Effect of Noise** Psychoacoustics and noise criteria; effects of noise on health; annoyance rating schemes	2
Module 9	**Noise Pollution Control** Noise Standards and Limits; Methods of Noise Pollution Control	4

Course Outcomes:

On successful completion of this course, student should be able to:

After going through this course, the students will be able to:

1. Define the basic concepts and terminologies regarding air pollution and noise pollution
2. Describe the physics of air pollution and noise pollution
3. Apply the methods of air pollution and noise pollution measurements
4. Analyze different concepts of air and noise pollution solving mathematical problems
5. Compare air and noise quality with allowable standards and limits. Choose and design proper techniques for air pollution control and noise pollution control

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes → / Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PE)703A. CO 1	3	3	2	1	-	-	-	-	-	-	-	-	3	2	-
CE(PE)703A. CO 2	3	3	2	-	-	-	-	-	-	-	-	-	3	2	-
CE(PE)703A. CO 3	3	3	2	2	2	-	-	-	-	-	-	-	3	-	-
CE(PE)703A. CO 4	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CE(PE)703A. CO 5	3	3	3	-	-	-	-	-	-	-	-	-	3	2	-
Avg.	3	2.6	2.25	2	2								3	2	

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Civil Engineering

Subject Code: CE(PE)705B	Category: Professional Elective Course
Subject Name: PAVEMENT DESIGN	Semester: VII
L-T-P: 2+0+0	Credit: 2

Pre-requisites : Transportation Engineering (CE(PC)506), Concrete Technology & RCC Design

COURSE OBJECTIVE

1. To be able to learn about characterization of material and design factors of pavement.
2. To able to analyze the stresses and design the flexible and rigid pavement.
3. To be able to study different types of pavement construction procedures.
4. To explain the role of various joints in a rigid pavement and its design

MODULE NO	Description of Topic	Contact Hours
Module 1	Pavement Design Flexible Pavement Design: Stresses and Deflections in homogeneous masses.; Burmaster's two layer theory; Three layer and multi-layer theories; wheel loadstresses, various factors in traffic wheel loads; ESWL of multiple wheels; McLeod method of design; AASTHO method of flexible pavement design. Low Volume Rigid Pavement: Criteria of Load, Scope and Specifications as per different Govt policies in India, Design Criteria.	13
Module 2	Pavement Construction and Management Flexible Pavement Construction: Earthwork (Method of Alignment-wise marking using chainage), compaction of embankments, construction methods and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers; Construction procedure of Low Volume Rigid Pavement.	9
Module 3	Pavement Evaluation - Pavement Distress Functional condition evaluation of pavements Roughness, Skid Resistance, Serviceability Index; Structural evaluation of pavements –Benkelman beam and Falling Weight Deflectometer; Pavement strengthening; Design of bituminous and concrete overlays as per IRC	8

COURSE OUTCOMES:

At the end of the course, students would be able to ---------

CO 1: Differentiate between different types of pavements, both structurally and functionally.Expose students to the analysis concepts and procedures for stresses, strains anddeflection in pavements..

CO 2. Conduct Axle Load Survey and Estimate Design Traffic.Expose students to the general aspects of pavement structural design, flexible or rigid.

CO 3. Analyze and design bituminous and cement concrete pavement using.Introduce students to the basic types and behaviour of highway materials

CO 4. Understand the principles of Pavement Maintenance and identify various pavement under distresses.

<u>PROGRAM SPECIFIC OUTCOMES (PSOs) :</u> The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: Able to understand the necessity of Civil Engineering solutions in a economical, Environmental and societal context.

<u>Mapping of Course outcomes with Program outcomes</u>

CO-PO-PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CE(PE)705B.1	2	-	-	-	-	-	-	-	1	-	2	-	3	1	1
CE(PE)705B.2	-	-	-	-	-	-	-	-		-	2	-	3	1	1
CE(PE)705B.3	-	-	-	-	-	-	-	-		-	2	-	3	1	1
CE(PE)705B.4	-	-	-	-	-	-	-	-	2	-	-	-	1	1	1
Average	2	-	-	-	-	-	-	-	1.5	-	2	-	2.5	1	1

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Civil Engineering

Subject Code: CE(PE)701C	Category: Professional Elective Course
Subject Name: HYDRAULIC STRUCTURES	Semester: VII
L-T-P: 2+1+0	Credit: 3

Prerequisites : Introduction to Civil Engineering CE(HS)302, Water Resources Engineering CE(PC)603, Fluid Mechanics.

COURSE OBJECTIVE

1. To impart knowledge about design and application of various hydraulic structures.
2. To introduce the fundamental concepts relevant to reservoir operations, cross drainage works, dams, spillways and energy dissipators.
3. To enable the students to understand the theoretical and practical application of these hydraulic structures.

MODULE NO	DESCRIPTIONS OF ITEMS	CONTACT HOURS
Module 1	Storage Structures: Dams, Types of Dams – Embankment dams, gravity dams, various components and their functions	2
Module 2	Selection of Dam Site: Site investigations, initial study, reconnaissance survey , geophysical investigations, preliminary selection, evaluation of selected site - various types of foundation testing, field testing and borrow pit investigations, detailed investigations; assessment of foundation characteristics and suitability ; selection of type of dam.	6
Module 3:	Gravity Dam: Definition, Features of some important gravity dams, Forces acting on a gravity dam, estimation of forces due to: self weight, water pressure on upstream and downstream face, Uplift pressure, wave pressure, silt pressure, wind pressure, earthquake forces, hydrodynamic forces; Stability analysis – load combinations, codal provisions, modes of failure overturning, sliding, tension and compression failures, factors of safeties, principal stresses; Elementary profile of a gravity dam forces acting, minimum base width no tension, no sliding basis, principal stresses.	12
	Embankment Dams: Definitions, Features of some important embankment dams; Types of embankment dams and their sectional features; Design criteria; Freeboard - necessity, estimation procedure; Seepage analysis - Laplace's flow equations, drainage blanket and rock toe, phreatic line, graphical procedure of drawing phreatic line, estimation of seepage loss; Stability analysis of embankment dams – slip circle method; Seepage Control – cut offs, slurry trench, sheet piling, grouting, slope protection.	8

	Diversion headworks: Necessity and uses, different types, layout and different components; weirs on permeable foundation, Creep theories, Khosla's method; Different types of modules, Canal escapes, Silt control devices.	8
Module 4:	Spillways and Energy Dissipation Structures: Necessity, types, selection, spillway gates; High overflow ogee spillway profile, discharge computation, flow equations, factors affecting coefficient of discharge, codal provisions. stilling	6

COURSE OUTCOMES:

On successful completion of this course, student should be able to: --------

CO1: Identify the characteristics of various types of dams and their selection procedure. Plan and design diversion head works. To analyse the functioning of diversion headwork's and energy dissipation.

CO2: Perform the reconnaissance survey and, geophysical investigations necessary for selection of suitable dam site

Works, falls and outlets of irrigation network.

CO3: Estimate forces acting on a gravity dams and perform stability analysis. Analyze gravity and earth dams

CO4: Estimate the seepage loss through embankment dams and suggest necessary remedial measures

CO5: Calculate the discharge through the overflow section and design the appropriate energy dissipation structures. Design spillways and energy dissipations works.

PROGRAM SPECIFIC OUTCOMES (PSOs) The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge ofscience, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: Able to understand the necessity of Civil Engineering solutions in a economical, Environmental and societal context

Mapping of Course outcomes with Program outcomes

CO-PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PE)701C.1	2	2	-	3	1	-	-	1	-	-	-	-	3	1	
CE(PE)701C.2	2	2	-	3	1	-	-	1	-	2	-	3	1	1	2
CE(PE)701C.3	3	1	1	3	-	-	-	1	-	-	-	-	3	1	-
C CE(PE)701C.4	2	2	-	3	-	-	-	-	-	-	-	-	3	1	-

CE(PE)701C.5	2	2	-	3	-	-	-	-	-	-	-	-	3	1	-
Average	2.2	1.8	1	3	1	-	-	1	-	2	-	3	2.6	1	2

1: Slightly 2: Moderately 3: Sub**stantially**

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(PE)702A	Category: Professional Elective Courses
Subject Name: Prestressed Concrete	Semester: VIII
L-T-P: 2+1+0	Credit: 3

Prerequisites : Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Design of RC Structures (CE(PC)501)

Course Objectives:

Students will gain knowledge on pre-stressed concrete behavior analysis methods, stress calculation, losses, limit state design criteria and methods. Student will be familiar with anchorage zone stress in post tension member. Basic knowledge on composite construction of pre-stressed and in situ concrete. Preliminary idea on partial pre-stressing and non stressed reinforcement.

Course Content:

Module No	Description of Topic	Contact Hrs.
Module 1	Introduction of Prestressed concrete: Materials, prestressing system, analysis of prestress and bending stress, losses Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsion shear and bending. Deflections of prestressed concrete members: Importance, factors, short term and long term deflection	12
Module 2	Shear and Torsional Resistance: Design of Shear Reinforcement, Design of Reinforcement for Torsion, Shear and Bending. Limit State Design Criteria: Inadequacy of Elastic and Ultimate Load Method, Criteria for Limit States, Strength and Serviceability. Design of Prestressed Concrete Section: for Flexure & methods by Lin and Magnel	12
Module 3	Anchorage Zone stresses in post tensioned members: Stress distribution in end block, anchorage zone reinforcement	4
Module 4	Statically Indeterminate Structures: Advantages of Continuous Member, Effect of Prestressing, Methods of Achieving Continuity and Method of Analysis of Secondary Moments	6
Module 5	Composite Construction of Prestressed and In-situ Concrete: Types, Analysis of Stresses	4

Module 6	Prestressed Concrete Poles and Sleepers: Design of Sections for Compression and Bending. Introduction to Partial Prestressing.	4

Course Outcomes:

After completing the course the student will be able to

1. Learn the introduction of prestressed concrete member and its deflection properties
2. Develop the design criteria of prestressed concrete section for flexure and shear properties
3. Analyze the anchorage zone stress for post-tensioned members
4. Impart knowledge regarding the methods of Analysis of Statically Indeterminate Structures & the composite construction of Prestress and In-situ concrete
5. Impart knowledge regarding Design of Prestressed concrete poles and sleepers and introduction of partial prestressing.

PROGRAM SPECIFIC OUTCOMES (PSOs) The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes → / ↓ **Course outcome**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PE)702A.1	3	3	2	1	-	-	1	-	-	-	-	2	3	1	-
CE(PE)702A.2	3	3	2	2	-	1	1	1	-	-	-	2	3	1	1
CE(PE)702A.3	3	3	2	1	-	-	-	-	-	-	-	1	3	-	-
CE(PE)702A.4	3	3	2	1	-	-	1	1	-	-	-	2	2	1	1
CE(PE)702A.5	3	3	3	2	-	1	-	1	-	2	-	3	3	-	1
Average	3.0	3.0	2.2	1.4	0	1.0	1.0	1.0	0	2.0	0	2.0	2.8	1.0	1.0

1: Slightly 2: Moderately 3: Substantially

Subject Code: **CE(PE)704B**	Category: **Professional Elective Courses**
Subject Name: **Advance Structural Analysis**	Semester: **VII**
L-T-P: **2-1-0**	Credit: **3**

PREREQUISITE:

Introduction to Solid Mechanics [CE(ES)402], Structural Analysis – I (CE(PC)503), Structural Analysis – II [CE(PE)602B]

COURSE OBJECTIVES:

Student will be able to apply stiffness and flexibility method using system approach. Also student will understand the yield conditions from their knowledge of stress-strain relations

COURSE CONTENT:

Module No	Description of Topic	Hours/ Week
1	**Matrix methods of structural analysis:** Application of matrix methods to plane truss, beams, continuous frames	14
2	**Finite difference and relaxation technique:** application to simple problems.	9
3	**Theory of plate bending:** Navier's Sol utions. Levy's solution. Plate buckling problem. Membrane theory of domes and cylindrical shells.	10
4	**Theory of Elasticity:** Three dimensional stress and strain analysis, stress strain transformation, stress invariants, equllibrium and compatibility equations. Two dimensional problems in Cartesian and polar coordinates. Plane stress, plane stain problems, St. Venant's principle	7

COURSE OUTCOMES (COs):

After going through this course, the students will be able to:

CO1. Basic Knowledge of the student will increase.
CO2. Student will be able to apply stiffness and flexibility method using system approach.
CO3. Student will understand the yield conditions from their knowledge of stress-strain relations.
CO4. Student will be able to solve simple plate and shell problems

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be:

PSO1. To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.
PSO2. To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.
PSO3. To manifest professional and ethical responsibilities while discharging duties.

Mapping of Course Outcomes with Program Outcomes

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PE)704B-CO1	1	3	3	1	3	-	2	1	2	2	-	3	2	3	3
CE(PE)704B-CO2	2	1	2	1	3	1	3	3	3	3	3	3	3	3	2
CE(PE)704B-CO3	1	2	3	1	2	-	1	-	-	1	-	3	2	3	3
CE(PE)704B-CO4	1	2	3	1	2	-	1	-	-	1	-	3	2	3	3
AVG.	1.25	2	2.75	1	2.5	1	1.75	2	2.5	1.75	3	3	2.25	3	2.75

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(IN)791	Category: Internship
Subject Name : Industrial Internship	Semester: VII
L-T-P: 0+0+0	Credit: 1

Pre-requisites :

1. Concrete technology
2. Design of reinforced concrete elements
3. Design of steel structures
4. Building planning and drawing

Course objectives:

Students have to undergo two-week practical training in Civil Engineering related organizations so that they become aware of the practical applications of theoretical concepts studied in the class rooms. At the end of the training student will submit a report as per the prescribed format to the department

Course Outcomes :

After successful completion of this course, the students should be able to

CO1: Handle and execute the civil engineering projects in the field.

Course Assessment methods:

Direct	Indirect
1. Report presentation	1. Course end survey

CO/PO Mapping :

CO-PO-PSO	**Programme Outcomes(POs)**														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CE(IN)791.1	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**3**	**-**	**3**	**1**	**2**	**3**
Average	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**2**	**3**	**-**	**3**	**1**	**2**	**3**

1: Slightly 2: Moderately 3: Substantially

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Assessment Process:

This course is mandatory and a student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: **CE(PROJ)881**	Category: **Project**
Subject Name: **Project-2 (Project Work Continued from VII)**	Semester: **VIII**
L-T-P: **0 – 0 - 10**	Credit: **5**

PREREQUISITE:

Designing and detailing of R.C.C Structures & Steel Structures , Foundation Engineering, Transportation Engineering

COURSE OBJECTIVE

To expose the students to project work on typical Civil Engineering problems.

Course Outcomes (COs):

At the end of the course, the student will be able to

CO1. Understand basic concept of R.C.C/ Steel Structures/ Traffic and Transportation Engineering/ Soil Mechanics.

CO2. Conceptualize various research works in the field of engineering

CO3. Analysis of different elements/ parameters of engineering

CO4. Design various members/ parameter of the structure /specific engineering problems

CO5. Submit detailed report on the project including detailing/ studied results of structures/ experiments/ real time collected data

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CE(PROJ)881. 1	3	1	-	-	-	-	2	-	-	-	-	-	3	-	1
CE(PROJ)881. 2	3	3	-	3	-	2	-	-	3	-	1	3	3	-	1
CE(PROJ)881. 3	3	3	2	3	3	2	2	3	3	2	1	3	3	3	2
CE(PROJ)881. 4	3	3	3	3	3	2	2	3	3	2	1	3	3	3	2
CE(PROJ)881. 5	3	3	3	3	3	2	2	3	3	3	-	-	3	3	2
Average	**3**	**2.6**	**2.67**	**3**	**3**	**2**	**2**	**3**	**3**	**2.33**	**1**	**3**	**3**	**3**	**1.6**

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Basic Science and Humanities

Subject Code: CE(HS)801	Category: Humanities and Social Sciences including Management courses
Subject Name: Professional Practice, law & Ethics	Semester: VIII
L-T-P: **2-0-0**	Credit:**2**

Course Objectives:

1 To create an awareness on Engineering Ethics and Human Values.
2 To instill Moral and Social Values and Loyalty
3 To create awareness on assessment of safety and risk
4 To introduce the Principles of Labour Law and Industrial Law and to enhance the understanding of Social Welfare Laws.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Professional Practice – Respective roles of various stakeholders: Government(constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice);professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction);Clients/ owners (role governed by contracts); Developers (role governed by regulations such asRERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (rolegoverned by contracts and regulatory Acts and Standards) **Professional Ethics** – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.	4
2	General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions &Force	18

	Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Nonperformance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms;	
3	Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law –Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.	5
4	Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour subcontract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act,1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017	2
5	Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;	1

Course Outcomes:

1. Learn more of Responsibilities and Rights as Professional and facing Global Challenges

2. Familiarize with the role of management and unions in the promotions of industrial relations and acquire knowledge about industrial peace, labour harmony and is capable to apply labour laws in day to day labour issues and problems.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(HS)801.CO1	-	-	-	2	-	-	2	3	-	2	-	3
CE(HS)801.CO2	-	-	-	-	-	-	-	2	-	2	-	3
CE(HS)801.CO3												
CE(HS)801.CO4												
CE(HS)801.CO5												
Average				.4			.4			.8		1.2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(OE)801C	Category: Open Elective Course
Subject Name: Deep Foundations	Semester: VIII
L-T-P: 2+0	Credit: 2

Course Objective:

Students will learn how to utilize their knowledge in soil mechanics to perform various types of engineering calculations. This includes Geotechnical analysis & design of Pile, Pier and well foundation.

Module No.	Description of Topics	Contact Hrs.
Module 1	**Piles:** types - load carrying capacity of pile - static and dynamic formula - pile load test - penetration test - pile groups - Efficiency - Feld's rule –Converse Labarre formula, Settlement of piles and pile groups - Negative skin friction – under-reamed piles, pile cap	10
Module 2	**Drilled Pier:** Introduction, uses, types, bearing capacity, settlement, construction procedures.	6
Module 3:	**Cassion foundations:** Types & selections, forces & moments, depth determination.	4
Module 4:	**Well foundations:** The Types, components, design of well foundations – grip, size, steining, curb, cutting edge, top & bottom plug, well cap; stability analysis of well foundation, construction, shift & tilts.	8

Course Outcomes:

On successful completion of this course, student should be able to:

1. Explain the concept of bearing capacity for deep foundation.
2. Estimate the safe bearing capacity including settlement consideration for deep foundations.
3. Select a suitable deep foundation system for various site conditions and also analysis of that.
4. Explain in what circumstances pile is needed and how to estimate pile and pile group

   Capacity under various soil conditions Characterize.

Programme Specific Outcomes:

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools.

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements.

PSO3: To manifest professional and ethical responsibilities while discharging duties.

Mapping of Course outcomes with Program outcomes

Program outcomes → / Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(OE)801C. CO 1	3	3	2	2	2	-	1	1	-	1	2	-	3	2	-
CE(OE)801C. CO 2	3	3	2	2	2	-	-	-	-	1	2	-	3	3	-
CE(OE)801C. CO 3	3	3	2	2	2	-	2	1	-	-	-	-	3	3	-
CE(OE)801C. CO 4	3	3	2	3	2	-	2	1	-	2	2	-	3	2	-
Avg.	3	3	2	2.25	2		1.67	1		1.34	2		3	2.5	

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Civil Engineering

Subject Code: CE(PE)801A	Category: Professional Elective Course
Subject Name: GIS & Remote Sensing	Semester: VIII
L-T-P: 2+0+0	Credit: 2

Prerequisite: Knowledge of Class-XII level physics, computer science, Knowledge of CE(PC)404 and CE(PC)494

COURSE OBJECTIVE

Apply the concepts of Photogrammetry and its applications such as determination of heights of objects on terrain. Understand the basic concept of Remote Sensing and know about different types of satellite and sensors. Illustrate Energy interactions with atmosphere and with earth surface features, Interpretation of satellite and top sheet maps. Understand different components of GIS and Learning about map projection and coordinate system Develop knowledge on conversion of data from analogue to digital and working with GIS software.

MODULE NO	DESCRIPTIONS ITEM	CONTACT HOURS
Module 1	Fundamentals of Remote Sensing: Energy sources and radiation principles; Electromagnetic Spectrum; Energy interactions in the atmosphere and with earth surface features; Atmospheric windows; Spectral response patterns and spectral signatures	3
Module 2	Digital Image Processing: Image rectification and restoration; Image enhancement; Image classification; Accuracy assessment; Digital change detection; Spatial, spectral, radiometric and temporal resolution characteristics of IRS, Landsat and Sentinel data.	6
Module 3	Advanced Remote Sensing: Microwave remote sensing: Frequency and wavelengths, polarization, range and azimuth resolution, relief displacement,	3

	foreshortening, layover, shadows and speckles; Synthetic Aperture Radar (SAR); Indian microwave sensors; Working principles of LiDAR remote sensing	
Module 4	Advanced Digital Image Processing: Principal Component Analysis (PCA); Colour Space Transformation; Fourier Transformation; Image fusion; Hybrid classification system	3
Module 5	GIS: Definition, components and applications of GIS; Spatial and attribute data; Raster vs. Vector GIS; Concept of topology; non-topological data structures	3
Module 6	Database and Coordinate System: Concepts of Relational Data Base Management System (RDBMS) and geodatabase; Spatial and attribute query; Datum and projection; Universal Transverse Mercator (UTM) grid system; On-the-fly projection	3
Module 7	Spatial Data Analysis: Concepts of local, focal, zonal and global analysis; Proximity analysis; Distance measurement; Raster and vector overlay; Spatial interpolation; DEM and TIN, Cost surface analysis	6
Module 8	Applications of GIS & Remote Sensing: Watershed analysis; Runoff and erosion modelling, Location and allocation analysis; Atmospheric pollution monitoring; Urban growth modelling; Carbon sequestration and climate change	5

Course Outcomes (COs):

At the end of the course, students would be able to -----

CO1-Define and state the scope GIS & remote sensing in civil engineering

CO2-Understand the basic principles of remote sensing and GIS

CO3-Apply the various methods of remote sensing and GIS to different geospatial datasets

CO4-Analyze the different results obtained from different remote sensing data sources

CO5-Evaluate the different results in solving real world problems. Design and construct optimum solutions for real world problems that can be resolved by GIS & remote sensing

PROGRAM SPECIFIC OUTCOMES (PSOs):

The student will be able:

PSO1: To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes/PSO → Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(PE)801A.1	3	1				1	2			3		3	2	2	3
CE(PE)801A.2		3											1		3
CE(PE)801A.3	3	3	2		3				3			3	3	2	3
CE(PE)801A.4		3	3	2	3				3				2	3	3
CE(PE)801A.5	3	3	3	3	3	3	3	2	3	3	3	3	1	2	3
Average	3	2	2.67	2.5	3	2	3	2	3	3	3	3	1.8	2.25	3

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: CE(OE)802B	Category: Open Elective Courses
Subject Name: Earthquake Engineering	Semester: VIII
L-T-P: 2-0-0	Credit: 2

Prerequisites : Introduction to Solid Mechanics (CE(ES)402), Structural Analysis – I (CE(PC)503), Structural Analysis – II (CE(PE)602B), Design of RC Structures (CE(PC)501), Structural Dynamics (CE(PE)704A).

Course Objectives:

Student should be able to deal dynamic behaviour and dynamics of structure as well as earthquake resistant design properly.

Course Content:

Module No	Description of Topic	Contact Hrs.
Module 1	Seismology: Earth's Interior and Plate Tectonics; Causes of Earthquakes and Seismic Waves; Measurement of Earthquakes and Measurement parameters; Modification of Earthquake due to the Nature of Soil; Seismic Hazard Analysis	4
Module 2	Earthquake Inputs: Time History Records and Frequency Contents of Ground Motion; Power Spectral Density Function of Ground Motion; Concept of Response Spectrums of Earthquake; Combined D-V-A Spectrum and Construction of Design Spectrum; Site Specific, Probabilistic and Uniform Hazard Spectrums; Predictive Relationships for earthquake parameters;	4
Module 3	Dynamics for Earthquake Analysis: Equations of Motion for SDOF and MDOF Systems; Undamped Free Vibration of SDOF and MDOF Systems; Mode Shapes and Frequencies of MDOF System; Rayleigh Damping Matrix; Direct Time Domain Analysis of MDOF System; Direct Frequency Domain Analysis of MDOF System; Modal Analysis in Time and Frequency Domain	4
Module 4	Response Analysis for Specific Ground Motion: Equations of Motion for Single and Multi- Support Excitations and Solutions; Equations of Motion in State Space and Solutions; Computational Steps for the Solutions using MATLAB; Time History Analysis of 3D Tall Buildings.	4

Module 5	Response Spectrum Method of Analysis: Concept of Equivalent Lateral Force for Earthquake; Modal Combination Rules; Response Spectrum Method of Analysis of Structures and Codal Provisions; Response Spectrum Method of Analysis for Torsionally Coupled Systems; Response Spectrum Method of Analysis for Non-Classically Damped Systems;	4
Module 6	Seismic Soil - Structure Interaction: Fundamentals of Seismic Soil-Structure Interaction; Direct Method of Analysis of Soil-Structure 6 Interaction using FEM and Use of ABAQUS, Substructuring Method of Analysis of Soil-Structure Interaction Problem	4
Module 7	Inelastic Response of Structures for Earthquake Forces: Fundamental Concepts of Inelastic Response Analysis for Earthquake Forces; Solutions of Incremental Equations of Motions for SDOF Systems; Solutions of Incremental Equations of Motions for MDOF Systems; Push over Analysis; Concepts of Ductility and Inelastic Spectrum;	5
Module 8	Base isolation for earthquake resistant design of structures: Base isolation concept, isolation systems and their modelling; linear theory of base isolation; stability of elastomeric bearings; codal provisions for seismic isolation, practical applications.	5

Course Outcomes:

After completing the course the student will be able to

1. provide a coherent development to them for the courses in sector of earthquake engineering.
2. present the foundations of many basic engineering concepts related earthquake Engineering
3. give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering
4. involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

PROGRAM SPECIFIC OUTCOMES (PSOs) The student will be:

PSO1 : To identify, formulate and solve civil engineering problems by applying knowledge of science, mathematics and engineering leveraging skills, techniques and various modern tools

PSO2: To meet desired economic, environmental, ethical, and sustainability constraints while designing civil engineering system or elements

PSO3: To manifest professional and ethical responsibilities while discharging duties

Mapping of Course outcomes with Program outcomes

Program outcomes → / Course outcome ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CE(OE)802B.1	3	3	3	2	1	1	1	-	-	-	1	2	3	1	-
CE(OE)802B.2	3	3	3	2	1	1	1	-	-	-	1	2	3	1	-
CE(OE)802B.3	3	3	3	3	2	1	1	1	-	1	2	1	3	1	1
CE(OE)802B.4	3	3	3	3	2	1	1	1	-	1	2	2	3	1	1
Average	3.0	3.0	3	2.5	1.5	1.0	1.0	1.0	0	1.0	1.5	2.0	3.0	1.0	1.0

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions

Department of Civil Engineering

Subject Code: -CE(CV)891	**Category: Comprehensive Viva Voce**
Subject Name: Comprehensive Viva Voce	**Semester: VIII**
L-T-P: 0+0+0	**Credit: 1**

Prerequisites : All Civil Engineering Subjects over 4 years of study in the undergraduate program

COURSE OBJECTIVES

The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Civil Engineering acquired over 4 years of study in the undergraduate program.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1. Evaluate overall technical knowledge and industry readiness

CO2 Analyze various applications of civil engineering in real life problem solving

CO3 Accustomed with virtual environment of technical interview

Mapping of Course outcomes with Program outcomes

CO-PO-PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CE(CV)89 1.1	2	-	3	2	-	-	-	2	-	-	-	1	2	2	-
CE(CV)89 1.2	2	-	3	2	-	-	-	2	-	-	-	1	2	2	1
CE(CV)89 1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CE(CV)89 1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CE(CV)89 1.5	2	-	3	2	-	-	-	2	-	-	-	1	2	2	-
Average	2	-	3	2	-	-	-	2	-	-		1	2	2	1

1: Slightly 2: Moderately 3: Substantially-

OmDayal Group of Institutions

Department of ELECTRICAL ENGINEERING

Subject Code: BS-M102	Category: Basic Science Course
Subject Name: Mathematics – IB	Semester: **I**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:

To motivate or challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Calculus (Integration):** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	**Calculus (Differentiation):** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	**Sequence and Series:** Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem	11
4	**Multivariate Calculus:** Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9
5	**Matrices:** Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8

Course Outcomes:

After completing the course, the student will be able to

1. Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
2. Understand the domain of applications of mean value theorems to engineering problems.
3. Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines
4. Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.
5. Understand the different types of matrices, concept of rank, methods of matrix inversion and their applications.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSM102.CO1	2	3	3	3	_	_	_	_	_	_	_	3

BSM102.CO2	3	3	1	2	_	_	_	_	_	_	_	3
BSM102.CO3	3	3	3	3	_	_	_	_	_	_	_	3
BSM102.CO4	3	3	2	3	_	1	_	_	_	_	_	3
BSM102.CO5	2	3	2	2	_	_	_	_	_	_	_	3
Average	2.6	3	2.2	2.6	_	1	_	_	_	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Course Code: BS-CH101	**Category:** Basic Science Courses
Course Title: Chemistry-I	**Semester**: I
L-T-P : **3-1-0**	**Credit:4**

Course Objectives:

To motivate students to understand the basic concepts of atomic and molecular structure, spectroscopic techniques and applications, free energy and equilibrium, periodic properties of elements and stereochemistry and structures of compounds and study the different types of organic reactions

Course Content:

Module No	Description of Topic	ContactHrs.
1	**Atomic and molecular structure:** Schrodinger equation. Particle in box solutions and their applications for simple sample. Molecular orbitalsof diatomic molecules (e.g.H_2). Energy level diagrams of diatomic. Pi-molecular orbital of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.	10
2	**Spectroscopic techniques and applications** Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering	8
3	**Intermolecular forces and potential energy surfaces** Ionic, dipolar and van Der Waals interactions. Equations of state of realgases and critical phenomena	4
4	**Use of free energy in chemical equilibria** First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.	8
5	**Periodic properties** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries	4
6	**Stereochemistry** Representations of 3 dimensional structures, structural isomers and	4

	stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds	
7	**Organic reactions and synthesis of a drug molecule** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.	4

Course Outcomes:

1. Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecularforces.
2. Rationalize bulk properties and processes using thermodynamic considerations.
3. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4. Rationalize periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
5. List major chemical reactions that are used in the synthesis of molecules.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BS-CH201.CO1	2	2					2					2
BS-CH201.CO2	2	2	2				2					2
BS-CH201.CO3	2	2	2		2		2					2
BS-CH201.CO4	2	2					2					2
BS-CH201.CO5	2	2	2		2							2
Average	2	2	2		2		2					2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Course Code: ES-EE101	**Category:** Engineering Science Courses
Course Title: Basic Electrical Engineering	**Semester: I**
L-T-P : 3-1-0	**Credit: 4**
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws,analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time- domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: **Transformers (6 hours)**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses intransformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage sourceinverters;

sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Course Outcomes

1. To understand and analyze DC circuits and relevant theorems.
2. To understand different AC network theorems, circuits and tools for solution of networks.
3. To study the working principles of power converters.
4. To introduce the components of low voltage electrical installations.
5. To understand basic concepts, construction, working principle and fundamentals of Electric Machines

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-EE101.CO1	3	3	3	2	3	3	1	-	-	-	-	3	3	3	3	3
ES-EE101.CO2	3	3	3	2	3	3	1	-	-	-	-	3	3	3	3	3
ES-EE101.CO3	3	3	3	2	3	3	2	-	-	-	-	3	3	3	3	3
ES-EE101.CO4	3	3	3	1	3	3	2	-	-	-	-	3	3	3	3	3
ES-EE101.CO5	3	3	3	1	3	3	2	-	-	-	-	3	3	3	3	3
Average	3	3	3	1.6	3	3	1.6	-	-	-	-	3	3	3	3	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Code: **BS-PH201**	Category: **Basic Science Courses**
Subject Name: **Physics-I**	Semester: **II**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:
To motivate or challenge students to understand basic concepts of mechanics, optics and itsapplications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Mechanics:** Problems including constraints & friction. Basic ideas of vector calculus and partial Differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a planeand in 3D. Angular velocity vector. Moment of inertia.	7
2	**Optics:** Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max; min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulaic only), characteristics of diffraction grating and its applications. Polarisation: Introduction, polarisation by reflection, polarisation by doublereflection, scattering of light, circular and elliptical polarisation, optical activity. Lasers: Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples.	5
3	**Electromagnetism and Dielectric Magnetic Properties of Materials:** Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation (expression only), applications of dielectrics. Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.	8

4	**Quantum Mechanics:** Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.	16
5	**Statistical Mechanics:** Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.	8

Course Outcomes:

1.Upon completion of this course, students will be able to understand the Basic concepts of mechanics, effect of various types of forces on a body, causes and effects of vibration.
2.Students will be able to interpret the intensity variation of light due to Polarization, interference and diffraction, transverse nature of Light-Polarization, Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
3.Upon completion of this course, students will be able to understand the magnetic and dielectric properties of various material and also properties of materials such as,permeability, polarization, etc .
4.Students will be familiar with some of the basic laws related to quantum mechanics as wellas simple quantum mechanics calculations.
5. Upon completion of this course, students will be able to understand the application of statistical Mechanics in case of Engineering Thermodynamics.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSPH101.CO1	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO2	3	3	3	3	3	2	_	_	_	_	_	3
BSPH101.CO3	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO4	3	3	3	3	3	3	_	_	_	_	_	3
BSPH101.CO5	3	3	3	3	2	2	_	_	_	_	_	3
Average	3	3	3	3	2.8	2.6	_	_	_	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Subject Code: BS-M202	Category: Basic Science Course
Subject Name: Mathematics – IIB	Semester: **II**
L-T-P: **3-1-0**	Credit:**4**

Course Objectives:
To motivate or challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Multivariate Calculus (Integration):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	11
2	**First order ordinary differential equations:** Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	5
3	**Ordinary differential equations of higher orders:** Second order linear differential equations with constant coefficients, Use of D- operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.	9
4	**Complex Variable – Differentiation**: Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties	6

5	Complex Variable – Integration Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville'stheorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour	9

Course Outcomes

1. Learn the methods for evaluating multiple integrals and their applications to different physical problems.
2. Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.
3. Learn different tools of differentiation and integration of functions of a complex variablethat are used with various other techniques for solving engineering problems.
4. Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.
5. Understand different techniques to solve Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions andused with various other techniques for solving engineering problems.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSM202.CO1	2	3	2	2	_	_	_	_	_	_	_	3
BSM202.CO2	2	3	3	2	_	_	_	_	_	_	_	3
BSM202.CO3	2	3	2	2	_	_	_	_	_	_	_	2
BSM202.CO4	2	3	2	2	_	_	_	_	_	_	_	2
BSM202.CO5	2	3	_	2	_	_	_	_	_	_	_	2
Average	2	3	2.25	2	_	_	_	_	_	_	_	2.4

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Subject Code: ES-CS201	Category: Engineering Science Courses
Subject Name: Programming for Problem Solving	Semester: **II**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:
The course is designed to provide complete knowledge of C language. Students will be able todevelop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future. The course aims to provide exposure to problem-solving through programming. It aims to train the student to the basic concepts of the C-programming language. This course involves a lab component which is designed to give the student hands-on experience with the concept.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.),Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code	4
2	Arithmetic expressions and precedence	2
3	Conditional Branching and Loops .Writing and evaluation of conditionals and consequent branching .Iteration and loops	6
4	Arrays (1-D, 2-D), Character arrays and Strings	6
5	Basic Algorithms. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)	6
6	Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference	5
7	Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	5
8	Structures, Defining structures and Array of Structures	4
9	Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)	2
10	File handling.	2

Course Outcomes:

1. To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).

2. To test and execute the programs and correct syntax and logical errors. To implement conditional branching, iteration and recursion
3. To decompose a problem into functions and synthesize a complete program using divide and conquer approach. To use arrays, pointers and structures to formulate algorithms and programs.
4. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems
5. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-CS201.1	2	3	1	1	1	1	2	3	-	2	3	1	2	2	1	-
ES-CS201.2	3	1	2	1	2	1	-	-	3	2	2	2	3	2	3	1
ES-CS201.3	2	3	2	2	2	-	2	3	3	2	3	2	2	-	3	3
ES-CS201.4	2	3	3	2	-	2	1	2	2	3	1	-	2	3	2	2
ES-CS201.5	3	3	2	2	2	2	1	-	3	3	2	3	3	3	2	1
Average	2.4	2.6	2	1.6	1.4	1.2	1.2	1.6	2.2	2.4	2.2	1.6	2.4	2.0	2.2	1.4

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Course Code : HM-HU201	**Category :** Humanities and Social Sciences including Management courses
Course Title : English	**Semester** : II
L-T-P : **2-0-0**	**Credit:2**
Pre-Requisites:	

COURSE OBJECTIVE :

To help students develop basic proficiency in English Grammar, Vocabulary and Composition, and writing skills.
To help students identify common errors in writing and gain editing skills in the process.
To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs and emails.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	1. Vocabulary Building 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending. 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms	
2	2. Basic Writing Skills 2.1 Sentence Structures & Types: Simple, Compound, Complex 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration 2.3 Importance of proper punctuation 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order 2.5 Creating Cohesion: Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely	
3	**3.** Identifying Common Errors in Writing 3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés	
4	4. Nature and Style of sensible Writing 4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion	
5	5. Writing Practices 5.1 Comprehension 5.2 Précis Writing 5.3 Essay Writing 5.4 Business Letter, Cover Letter & CV; E-mail	

Course Outcome:

1)The student will acquire basic proficiency in English including reading and listening comprehension.

2)The student will acquire basic proficiency in English grammar and vocabulary.

3)The student will acquire basic proficiency in writing basic technical documents such as business letters, cover letters, cv and emails.

4)The student will acquire the ability to identify common errors and edit accordingly.

5)The student will acquire the ability to understand the nature and style of writing.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HM-HU201.CO1	-	2	-	2	-	1	-	2	1	3	1	3
HM-HU201.CO2	-	-	1	1	-	1	-	2	-	3	-	3
HM-HU201.CO3	-	2	2	2	-	2	1	3	3	3	2	3
HM-HU201.CO.4	-	2	1	-	-	-	1	3	2	3	-	3
HM-HU201.CO.5	-	1	1	1	-	1	1	3	1	3	1	3
Average:	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Name of the course		**ELECTRIC CIRCUIT THEORY**	
Course Code: PC-EE 301		**Semester: 3rd**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		**Mid Semester Exam: 15 Marks**	
Tutorial: 1 hr/week		**Assignment & Quiz: 10 Marks**	
Practical: 2 hrs/week		**Attendance: 05 Marks**	
Credit Points: 4+1		**End Semester Exam: 70 Marks**	
Objective:			
1.	To understand the structure and properties of different type of electrical circuits, networks and sources.		
2.	To apply different mathematical tools & techniques for analyzing electrical networks.		
3.	To apply circuit analysis techniques to simplify electrical networks..		
4.	To solve problems of electrical circuits.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Mathematics (BS-M-102, Bs-M202)		
Unit	**Content**	**Hrs**	**Marks**
1	**Introduction**: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals	3	
2	**Graph theory and Networks equations:** Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Duality, Solution of Problems	4	
3	**Coupled circuits:** Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems.	3	
4	**Laplace transforms:** Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions. Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources.	8	
5	**Fourier method of waveform analysis:** Fourier series and Fourier Transform (in continuous domain only). Application in circuit analysis, Solution of Problems	6	
6	**Network Theorems:** Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem and its application in three phase unbalanced circuit analysis. Solution of Problems with DC & AC sources.	8	
7	**Two port networks analysis:** Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems	4	
8	**Filter Circuits:** Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems	4	

Course Outcome: After completion of this course, the learners will be able to

1. describe different type of networks, sources and signals with examples.
2. explain different network theorems, coupled circuit and tools for solution of networks.
3. apply network theorems and different tools to solve network problems.
4. select suitable techniques of network analysis for efficient solution.
5. estimate parameters of two-port networks and design filter circuits.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE 301.CO1	2	2	2	1	-	2	2	3	2	2	-	3	3	2	-	2
PC-EE 301.CO2	2	2	2	2	-	2	1	2	1	1	-	2	3	2	-	2
PC-EE 301.CO3	2	3	2	2	-	2	2	2	1	1	-	2	3	2	-	2
PC-EE 301.CO4	2	2	3	2	-	1	1	1	2	2	-	1	3	3	-	2
PC-EE 301.CO5	2	2	2	2	-	1	1	2	2	2	-	2	3	3	-	2
Average	2	2.2	2.2	1.8	-	1.6	1.4	2	1.6	1.6	-	2	3	2.4	-	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**ANALOG ELECTRONICS**
Course Code: PC-EE 302	**Semester: 3rd**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 2 hrs/week	Attendance: 05 Marks
Credit Points: 3+1	End Semester Exam: 70 Marks

Objective:	
1.	To understand the structure and properties of different components of analog electronics.
2.	To explain principle of operation of analog electronics components and circuits.
3.	To understand the application of operational amplifier
4.	To solve problems of analog electronic components and circuits
5.	To analyze amplifiers, oscillators and other analog electronic circuits.
Pre-Requisite	
1.	Physics (10+2)

Unit	Content	Hrs	Marks
1	**Filters & Regulators**: Review of half wave and full wave rectifier**,** Capacitor filters, □-section filter, ripple factor, series and shunt voltage regulator, percentage regulation.	4	
2	**BJT circuits:** Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits	8	
3	**MOSFET circuits:** MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common- source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.	8	
4	**Feed back amplifier & Oscillators:** Concept of Feed back, Negative & Positive feedback, Voltage/Current, Series/Shunt feedback, Berkhausen criterion, Colpit , Hartley's, Phase shift, Wien bridge, & Crystal oscillators.	5	

5	**Operational amplifier:** Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower/Buffer circuits.	5	
6	**Application of Operational amplifiers:** Adder, Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog amplifier, Trans-conductance multiplier, Precision rectifier, Voltage to current &Current to voltage converter.	5	
7	**Power amplifier:** Class A, B, AB, C, Conversion efficiency	2	
8	**Multivibrator:** Monostable, Bistable multivibrator, Monostable & Astable operation using 555 timer.	2	
9	**Special function circuits:** VCO & PLL	2	

Course Outcome: After completion of this course, the learners will be able to

1. Describe analog electronic components and analog electronics circuits
2. Explain principle of operation of analog electronic components, filters, regulators and analog electronic circuits.
3. Compute parameters and operating points of analog electronic circuits.
4. Determine response of analog electronic circuits.
5. Distinguish different types amplifier and different types oscillators based on application and construct operational amplifier-based circuits for different applications.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-302.CO1	3	2	2	2	1	1	-	-	1	2	-	1	3	3	-	3
PC-EE-302.CO2	3	3	2	2	-	1	-	-	2	2	-	1	3	2	-	3
PC-EE-302.CO3	3	3	3	3	-	1	-	-	3	3	-	1	3	3	2	2
PC-EE-302.CO4	3	3	3	2	-	2	-	-	3	2	-	1	3	3	1	3

PC-EE-302.CO5	3	3	3	2	-	2	-	-	3	3	-	1	3	3	2	3
Average	3	2.75	2.6	2.2	1	2	-	-	2.4	2.4	-	1	3	2.8	1.67	2.8

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**ELECTRO MAGNETIC FIELD THEORY**
Course Code: PC-EE 303	**Semester: 3rd**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	**Mid Semester Exam: 15 Marks**
Tutorial: 0 hr/week	**Assignment & Quiz: 10 Marks**
Practical: 0 hrs/week	**Attendance: 05 Marks**
Credit Points: 3	**End Semester Exam: 70 Marks**

Objective:	
1.	To understand the basic mathematical tools to deal with Electromagnetic field Problem.
2.	To understand properties and application of Electric and magnetic field.
3.	To analyze electromagnetic wave propagation
4.	To solve problem related to Electromagnetic field.

Pre-Requisite	
1.	Basic Electrical Engineering (ES-EE-101)
2.	Mathematics (BS-M-102, Bs-M202)
3.	Physics (BS-PH 101)

Unit	**Content**	**Hrs**	**Marks**
1	**Introduction:** Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems	4	
2	**Introduction to Vector calculus:** DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Strokes theorem, Laplacian of a scalar, Classification of vector fields, Helmholtz's theorem. Solution of problems	4	
3	**Electrostatic field:** Coulomb's law, field intensity, Gauss's law, Electric potential and Potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor –dielectric, Conductor-free space. Poisson's and Laplace's equation, General procedure for solving Poisson's and Laplace's equation. Solution of problems	8	
4	**Magneto static fields:** Biot- savart law, Ampere's circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetisation in material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material. Solution of problems	8	
5	**Electromagnetic fields:** Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Time varying Potential, Time harmonic fields. Solution of problems	6	
6	**Electromagnetic wave propagation:** Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems	6	

7	**Transmission line:** Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems	4	

Course Outcome: After completion of this course, the learners will be able to

1. Relate different coordinate systems for efficient solution of electromagnetic problems.
2. Describe mathematical tools to solve electromagnetic problems and explain laws applied to electromagnetic field.
3. Apply mathematical tools and laws to solve electromagnetic problems.
4. Analyze electromagnetic wave propagation
5. Estimate transmission line parameters.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PCEE303.CO1	3	3	3	3	2	3	2	_	_	_	_	3
PCEE303.CO2	3	3	3	3	3	2	2	_	_	_	_	3
PCEE303.CO3	3	3	3	3	3	2	3	_	_	_	_	3
PCEE303.CO4	3	3	3	3	3	3	3	_	_	_	_	3
PCEE303.CO5	3	3	3	3	3	3	2	_	_	_	_	3
Average	3	3	3	3	2.8	2.6	2.4	_	_	_	_	3

PO1: Engineering Knowledge

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PO12: Life-long Learning

Name of the course		**ENGINEERING MECHANICS**	
Course Code: ES-ME 301		**Semester: 3rd**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basic mathematical tools to deal with the physical bodies.		
2.	To learn different mathematical techniques to analyze physical bodies.		
2.	To learn analysis techniques of rigid bodies.		
2.	To solve problem of general motion.		
Pre-Requisite			
1.	Physics (BS-PH-101)		
2.	Mathematics (BS-M102, BS-M202)		
Unit	Content	Hrs	Marks
1	**Introduction to vectors and tensors and co-ordinate systems** Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigenvalues and Principal axes.	5	
2	**Three-dimensional Rotation** Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.	4	
3	**Kinematics of Rigid Body** Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two- and three dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.	6	
4	**Kinetics of Rigid Bodies** Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems;	5	

	Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.		
5	**Free Body Diagram (1 hour)** Free body diagrams; Examples on modelling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.	1	
6	**General Motion** Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.	9	
7	**Bending Moment** Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.	5	
8	**Torsional Motion** Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.	2	
9	**Friction** Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.	3	

Course Outcome: After completion of this course, the learners will be able to

1. explain the co-ordinate system, principle of three dimensional rotation, kinematics and kinetics of rigid bodies.
2. elaborate the theory of general motion, bending moment, torsional motion and friction.
3. develop free body diagram of different arrangements.
4. solve problems with the application of theories and principle of motion , friction and rigid bodies.
5. analyze torsional motion and bending moment.

PO/PSO → **Course outcome ↓**	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
ES-ME 301.CO1	3	2	1	1	-	-	-	-	-	1	-	-	3	3	3	3
ES-ME 301.CO2	3	2	1	1	-	-	-	-	-	1	-	-	3	3	3	3
ES-ME 301.CO3	3	2	1	1	-	-	-	-	-	1	-	-	3	3	3	3
ES-ME 301.CO4	3	2	1	1	-	-	-	-	-	1	-	-	3	3	3	3
ES-ME 301.CO5	3	2	1	1	-	-	-	-	-	1	-	-	3	3	3	3
Average	3	2	1	1	-	-	-	-	-	1	-	-	3	3	3	3

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PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course		**MATHEMATICS-III**	
Course Code: BS- M 301		**Semester: 3rd**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand Probability theory required an Electrical Engineer to apply in profession.		
2.	To understand numerical methods to solve engineering problem		
3.	To understand basics of Z transform to solve engineering problems.		
Pre-Requisite			
1.	Mathematics (10+2)		
Unit	Content	Hrs	Marks
1	**Probability:** Basic Probability Theory**:** Classical definition and its limitations. Axiomatic definition. Some elementary deduction: i) P(O)=0, ii) 0≤P(A)≤1, iii) P(A')=1-P(A) etc. where the symbols have their usual meanings. Frequency interpretation of probability.	1	
	Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pair wise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems.	3	
	Random Variable & Probability Distributions. Expectation: Definition of random variable. Continuous and discrete random variables. Probability density function & probability	2	

	mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples. Some important discrete distributions: Binomial & Poisson distributions and related problems. Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only.	2	
2	**Numerical Methods:** Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method. Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.	4 5 3 6 4 6	
3	**Z transform:** Sequence, Representation of sequence, Basic operations on sequences, Z-transforms, Properties of Z-transforms, Change of scale, Shifting property, Inverse Z-transform, Solution of difference equation , Region of convergence.	4	

Course Outcome: After completion of this course, the learners will be able to

1. explain basics of probability theories, rules, distribution and properties of Z transform
2. describe different methods of numerical analysis.
3. solve numerical problems based on probability theories , numerical analysis and Z transform
4. apply numerical methods to solve engineering problems.
5. solve engineering problems using z transform and probability theory.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSM301.CO1	2	2	3	3	_	_	_	_	_	_	_	3
BSM301.CO2	_	3	2	2	_	_	_	_	_	_	_	3
BSM301.CO3	_	3	3	2	_	_	_	_	_	_	_	3
BSM301.CO4	1	3	2	3	_	_	_	_	_	_	_	3
BSM301.CO5	2	3	3	3	_	_	_	_	_	_	_	3
Average	1.67	2.8	2.6	2.6	_	_	_	_	_	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

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PO4: Conduct Investigations of Complex Problems

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PO12: Life-long Learning

Name of the course	**BIOLOGY FOR ENGINEERS**
Course Code:BS- 301	**Semester: 3rd**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: 0 hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To introduce modern biology with an emphasis on evolution of biology as a multi-disciplinary field.
2.	To make students aware of application of engineering principles in biology and engineering robust solution inspired by biological examples.

Pre-Requisite

1.	NIL

Unit	Content	Hrs	Marks
1	**Introduction** Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific Inquiry	2	
2	**Classification:** Purpose: To convey that classification *per se* is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructureprokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus.	3	

3	**Biomolecules** Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine. Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	4	
4	**Macromolecular analysis:** Purpose: To analyze biological processes at the reductionistic level. Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5	
5	**Metabolism** Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.	4	
6	**Microbiology** Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3	

7	**Immunology** Purpose: How does the immune system work? What are the molecular and cellular components and pathways that protect an organism from infectious agents or cancer? This comprehensive course answers these questions as it explores the cells and molecules of the immune system. Immunology- Self vs Non-self, pathogens, human immune system, antigen-antibody reactions.	5	
8	**Information Transfer** Purpose: The molecular basis of coding and decoding genetic information is universal. Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. s •on cell proliferation • metastasis • cell proliferation • cell death • cell	4	
9	**Cancer biology** Purpose: A basic understanding of cancer biology and treatment. The course is not designed for patients seeking treatment guidance – but it can help to understand how cancer develops and provides a framework for understanding cancer diagnosis and treatment. –cell Identification of the major types of cancer worldwide. Description of how genes contribute to the risk and growth of cancer. List and description of the ten cellular hallmarks of cancer. Definition of metastasis, and identification of the major steps in the metastatic process. Description of the role of imaging in the screening, diagnosis, staging, and treatments of cancer. Explanation of how cancer is treated.	5	
10	**Techniques in bio physics** Purpose: Biophysics is an interdisciplinary science that applies approaches and methods traditionally used in physics to study biological phenomena. The techniques including microscopy, spectroscopy, electrophysiology, single-molecule methods and molecular modeling	3	

11	**Stem cell** Purpose: Stem cells and derived products offer great promise for new medical treatments. Learn about stem cell types, current and possible uses, ethical issues.	2	

Course Outcome: After completion of this course, the learners will be able to

1. Describe with examples the biological observations lead to major discoveries.
2. Explain the classification of kingdom of life/ the building blocks of life/ different techniques of bio physics used to study biological phenomena/ the role of imaging in the screening, diagnosis, staging, and treatments of cancer.
3. Identify DNA as a genetic material in the molecular basis of information transfer
4. Analyze biological processes at the reductionist level.
5. Apply thermodynamic principles to biological systems and identify microorganisms

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BS301.CO1	2	-	-	-	2	2	_	_	_	_	_	3
BS301.CO2	1	2	-	-	1	2	3	-	-	-	-	3
BS301.CO3	1	3	2	-	2	2	3	-	-	-	-	3
BS301.CO4	-	2	-	-	1	1	2	-	-	-	-	3
BS301.CO5	2	2	1	-	-	2	2	-	-	-	-	3
Average	1.5	2.25	1.5	-	1.5	1.8	2.5	-	-	-	-	3

PO1: Engineering Knowledge

PO2: Problem Analysis

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PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Name of the course		**INDIAN CONSTOTUTION**	
Course Code: MC-EE 301		**Semester: 3rd**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 0		End Semester Exam: 70 Marks	
Objective:			
1.	To have basic knowledge about Indian Constitution.		
2.	To understand the structure and functioning of union, state and local self-government.		
3.	To understand the structure, jurisdiction and function of Indian judiciary.		
Pre-Requisite			
1.	NIL		
Unit	Content	Hrs	Marks
1	**Indian Constitution:** Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	5	
2	**Union government and its administration:** Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. **State government and its administration:** Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	10	
3	**Supreme court:** Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. **High court:** Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. **Subordinate courts:** constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for admitting PIL	10	
4	**Local Administration:**	10	

	District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.		

Course Outcome:

After completion of this course, the learners will be able to :

1. Describe different features of the Indian constitution, power and functioning of Union, state and local self-government, structure, jurisdiction and function of Indian Judiciary, basics of PIL and guideline for admission of PIL.
2. Understand the functioning of local administration starting from block to Municipal Corporation.
3. Identify authority to redress a problem in the profession and in the society.
4. Build a sound knowledge regarding the history of the Indian Constitution
5. Understand and evaluate the features of the Indian Constitution

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC EE-301 CO1	-	-	-	1	-	2	-	3	3	1	-	3
MC EE-301. CO2	-	1	1	1	-	2	-	2	3	1	1	3
MC EEE - 301. CO3	-	2	2	2	-	2	-	3	2	2	1	3
MC EE-301. CO. 4	-	-	-	-	-	1	-	-	2	1	-	3
MC EE 301. CO. 5	-	1	-	-	-	2	-	2	2	2	1	3
Aver	-	1.33	1.5	1.33	-	1.8	-	2.5	2.4	1.4	.75	3

age:												

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Name of the course	ELECTRIC MACHINE-I		
Course Code: PC-EE-401	**Semester: 4th**		
Duration: 6 months	**Maximum Marks: 100**		
Teaching Scheme	**Examination Scheme**		
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks		
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks		
Practical: hrs/week	Attendance: 05 Marks		
Credit Points: 3	End Semester Exam: 70 Marks		
Objective:			
1.	To review the concept of magnetic fields and magnetic circuits		
2.	To learn the principle of production of electromagnetic force and torque.		
3.	To learn the basic principle of operation of DC machine		
4.	To learn the principle of operation and characteristics of DC motor and generator		
5.	To learn the principle of operation, connections and different tests on Transformers		
6.	To acquire problem solving skills to solve problems of DC machines and Transformers		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
3.	Electromagnetic Field Theory (PC-EE-303)		
Unit	**Content**	**Hrs**	**Marks**
1	**Magnetic fields and magnetic circuits:** Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.	3	
2	**Electromagnetic force and torque:** B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency	5	
3	**DC machines:** Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an	8	

	armature coil. Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.		
4	**DC machine - motoring and generation:** Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines	7	
5	**Transformers:** Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.	12	

Course Outcome:

After completion of this course, the learners will be able to

1. describe the function of different components of magnetic circuit, DC machines and transformers
2. explain the principle of operation of different types of DC machines and transformers
3. solve numerical problems of DC machines and transformers.
4. estimate the parameters and efficiency of transformer.
5. determine the characteristics of DC machines and recommend methods to control output of DC machines.

PO- PSO CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-401-CO1	3	1	1	-	-	2	2	1	2	2	-	2	3	2	-	2
PC-EE-401-CO2	3	1	1	2	3	2	1	2	2	2	-	1	3	2	-	2
PC-EE-401-CO3	3	3	3	3	3	2	2	2	3	2	-	2	3	2	2	2
PC-EE-401-CO4	3	3	3	2	2	2	1	1	2	2	-	1	3	3	2	2
PC-EE-401-CO5	3	3	3	2	-	2	1	2	2	2	-	2	3	3	2	2
Average	3	2.2	2.2	2.25	2.67	2	1.4	1.6	2.2	2	-	1.6	3	2.4	2	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**DIGITAL ELECTRONICS**
Course Code: PC-EE-402	**Semester: 4th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: hrs/week	Attendance: 05Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:	
1.	To learn the fundamentals of Digital systems and principle of operation of Logic families.
2.	To learn the principle of operation of Combinational digital circuits.
3.	To learn the principle of operation of sequential circuit and systems.
4.	To learn the principle of operation of A/D and D/A converter
5.	To learn the principle of operation of semiconductor memories and Programmable logic devices.
6.	To acquire problem solving skills to solve problems of Digital circuits
Pre-Requisite	
1.	Analog Electronics (PC-EE-302)

Unit	Content	Hrs
1	**Fundamentals of Digital Systems and logic families:** Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.	7
2	**Combinational Digital Circuits:** Standard representation for logic functions, K-map representation, simplification of Logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of functionrealization.	7
3	**Sequential circuits and systems:** A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flipflops, applications of flipflops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters	7

4	**A/D and D/A Converters:** Digital to analog converters: weighted resistor/converter, R-2R Ladder, D/A converter, specifications for D/A converters, examples of D/A converter, lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converterICs.	7
5	**Semiconductor memories and Programmable logic devices:** Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).	7

Course Outcome:

After completion of this course, the learners will be able to

1. Describe the function of different building blocks of digital electronics, semiconductor memories and programmable logic devices.
2. Explain the principle of operation of combinational and sequential digital circuits, A/D and D/A converter
3. Solve numerical problems of Boolean algebra, number system, combinational & sequential digital circuits and A/D and D/A converter.
4. Specify applications of combinational and sequential digital circuits.
5. Determine specifications of different digital circuits and design combinational and sequential digital circuits

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-402.CO1	3	3	1	1	-	2	-	-	3	2	-	1	3	2	1	2
PC-EE-402.CO2	3	3	2	1	-	1	-	-	3	3	-	1	3	2	2	2
PC-EE-402.CO3	3	3	2	3	-	1	-	-	3	3	-	1	3	2	1	2

PC-EE-402.CO4	3	3	3	3	3	2	-	-	3	3	-	2	3	3	3	3
PC-EE-402.CO5	3	3	2	2	-	2	-	-	3	2	-	1	3	3	2	2
Average	3	3	2	2	3	1.6	-	-	3	2.6	-	1.2	3	2.4	1.8	2.2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course		**ELECTRICAL & ELECTRONICS MEASUREMENTS**	
Course Code: PC-EE-403		**Semester: 4th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To learn methods of measurement, errors in measurement and its classification.		
2.	To learn the principle of operation of analog and digital meters.		
3.	To learn the basic principle of operation of instrument transformers.		
4.	To learn the principle of operation of cathode ray oscilloscope and different sensors and transducers.		
5.	To learn the principle of measurement of power, energy and different electrical parameters		
6.	To acquire problem solving skills to solve problems on the topics studied.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
Unit	**Content**	**Hrs**	**Marks**
1	**Measurements:** • Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments. **Analog meters:** • General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments , Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.	7	
2	**Instrument transformer:** • Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors. **Measurement of Power:** • Principle of operation of Electrodynamic & Induction type wattmeter, Wattmeter errors **Measurement of Energy:** • Construction, theory and application of AC energy meter, testing of energy meters.	9	
3	**Measurement of resistance:** • Measurement of medium, low and high resistances, Megger **Potentiometer:** • Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer, applications	8	

	AC Bridges: • Measurement of Inductance, Capacitance and frequency by AC bridges		
4	**Cathode ray oscilloscope (CRO):** • Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO. **Electronic Instruments:** • Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator, Digital Storage oscilloscope.	7	
5	**Sensors & Transducers:** • Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.	4	

Course Outcome:

After completion of this course, the learners will be able to

1. explain the terms accuracy, precision, resolution, speed of response, errors in measurement, loading effect
2. describe methods of measurement of power, energy by instruments and resistance, capacitance and inductance by bridges and potentiometer
3. explain the principle of operation of analog meters, instrument transformer, digital multimeter, digital voltmeter, digital frequency meter, signal generator, strain gauge, LVDT and temperature transducers
4. explain the different building block, principle of operation of oscilloscope and measurement techniques of voltage, current, frequency and phase by oscilloscope
5. solve numerical problems related to analog meters, instrument transformer, measurement of power, energy, resistance, inductance and capacitance. specify applications of analog and digital measuring instruments, sensors and transducers

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE-403.CO1	3	3	-	1	-	2	2	2	2	2	-	3	3	2	-	1
PC-EE-403.CO2	2	2	1	2	-	2	1	2	2	1	-	2	3	2	-	2
PC-EE-403.CO3	3	2	2	2	-	2	2	2	1	1	-	2	3	2	-	2
PC-EE-403.CO4	2	2	3	2	-	2	1	1	2	2	-	1	3	3	-	2
PC-EE-403.CO5	3	2	2	2	-	2	1	2	2	2	-	2	3	3	-	2
Average	2.6	2.4	2	1.8	-	2	1.4	1.8	1.8	1.6	-	2	3	2.4	-	1.8

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PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**THERMAL POWER ENGINEERING**
Course Code:ES-EE-401	**Semester: 4th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Practical: hrs/week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To learn the principle of operation of different types of boilers and Turbines
2.	To learn the principle of operation of IC engines and Gas turbines
3.	To acquire problem solving skills to solve problems of boilers, turbines, IC engines and Gas Turbines

Pre-Requisite

1.	Mathematics (BS M102 & BS M201)

Unit	Content	Hrs	Marks
1	**Boilers:** Water Tube & Fire Tube boilers, Circulating Principles, Forced Circulation, Critical pressure, Superheaters, Reheaters, attemperators, induced draught, forced draught and secondary air Fans, Boiler performance analysis and heat balance. Combustion Systems, Environmental Protection – ESP, Cyclone Separator, Dust Collector etc.	12	
2	**Turbines:** Rotary Thermodynamic devices – Steam turbines & their classifications – Impulse & Reaction typeTurbines, Thermodynamics of compressible fluid-flow, equation and continuity – Isentropic flow throughnozzles, velocity diagram, Blade efficiency, optimum velocity ratio, multi-staging, velocity & pressurecompounding, losses in turbines, erosion of turbine blades, turbine governing, performance analysis ofturbine, Condensing system.	12	
3	**IC Engines:** IC Engines – classification, Analysis of a standard cycle, fuel characteristic of SI & CI Engine,Combustion, Engine performance Automotive Engine exhaust emission and their control	6	
4	**Gas Turbines:** Gas turbine Analysis – Regeneration - Reheating, Isentropic efficiency Combustion efficiency	5	

Course Outcome:

After completion of this course, the learners will be able to

1. describe the function of different components of boilers. Engines and turbines
2. explain the principle of operation of different types of boilers, turbines, IC engines and Gas turbines.
3. solve numerical problems of boilers, turbines, IC engines and Gas turbines.
4. analyze the performance of boilers, engines and turbines.
5. determine efficiency of boilers, engines and turbines. Also explain methods to control boiler, engines and turbines parameters.

PO-PSO CO	PO1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
ES-EE-401.CO1	3	3	3	3	3	-	2	-	1	1	-	3	3	3	2	2
ES-EE-401.CO2	3	3	3	3	3	-	2	-	1	1	-	3	3	3	2	2
ES-EE-401.CO3	3	3	3	3	3	-	2	-	1	1	-	3	3	3	2	2
ES-EE-401.CO4	3	3	3	3	3	-	2	-	1	1	-	3	3	3	2	2
ES-EE-401.CO5	3	3	3	3	3	-	2	-	1	1	-	3	3	3	2	2
Average	3	3	3	3	3	-	2	-	1	1	-	3	3	3	2	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

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PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course		**VALUES AND ETHICS IN PROFESSION**	
Course Code: HM-EE-401		**Semester: 4th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To inculcate Human values to grow as a responsible human beings with a proper personality.		
2.	To instill Professional Ethics to maintain ethical conduct and discharge professional duties.		
Pre-Requisite			
1.	Not applicable		
Unit	**Content**	**Hrs**	**Marks**
1	**Human values:** Morals, Values, and Ethics – Integrity –Trustworthiness – Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.	5	
2	**Principles for harmony:** Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness	5	
3	**Engineering ethics and social experimentation:** History of Ethics – Need of Engineering Ethics – Senses of Engineering Ethics- Profession and Professionalism —Self Interest – Moral Autonomy – Utilitarianism – Virtue Theory – Uses of Ethical Theories – Deontology- Types of Inquiry –Kohlberg’s Theory – Gilligan’s Argument – Heinz’s Dilemma – Comparison with Standard Experiments — Learning from the Past – Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law – Role of Codes – Codes and Experimental Nature of Engineering.	8	
4	**Engineers’ responsibility towards safety and risk for sustainable development:** The concept of Safety – Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences – Risk Assessment –Accountability – Liability – Reversible Effects – Threshold Levels of Risk – Delayed v/s Immediate Risk – Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.	5	
5	**Engineers’ duties and rights:** Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and		

	Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes – Problem solving-Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.	7	
6	**Global issues:** Globalization and MNCs –Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics – Research Ethics - Intellectual Property Rights.	5	

Course Outcome:

After completion of this course, the learners will be able to

1. illustrate different aspects of human values, ethics, engineers' responsibility and duties
2. explain different principles, different theories and laws of engineering ethics and social experimentation
3. identify different factors in the light of Engineers' responsibility towards safety and risk
4. correlate ethics of different work environment.
5. explain the need for intellectual property rights.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HMEE401.CO1	-	-	-	-	-	-	-	3	-	-	-	3
HMEE401.CO2	1	-	-	-	-	-	-	2	-	-	-	3
HMEE401.CO3	2	-	-	-	-	-	-	2	-	2	-	3
HMEE401.CO4	1	-	-	-	-	-	2	3	-	2	2	3
HMEE401.CO5	-	-	-	2	-	-	-	-	-	-	2	3
Average	1.5	-	-	2	-	-	2	2	-	2	2	3

PO1: Engineering Knowledge

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PO12: Life-long Learning

Name of the course	**ENVIRONMEMTAL SCIENCE**		
Course Code: MC-EE-401	**Semester: 4th**		
Duration: 6 months	**Maximum Marks: 100**		
Teaching Scheme	**Examination Scheme**		
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks		
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks		
Practical: 0 hrs/week	Attendance: 05 Marks		
Credit Points: 0	End Semester Exam: 70 Marks		
Objective:			
1.	To understand the environment and its relationships with human activities		
2.	To be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk		
3.	To understand environmental laws and regulations to develop guidelines and procedures for health and safety issues		
4.	To acquire the skill to solve problem related to environment and pollution		
Pre-Requisite			
1.	Basic knowledge of science		
Unit	**Content**	**Hrs**	**Marks**
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non- renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development (2L). Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function (1L). Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering (2L)	6	
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem-components types and function (1L). Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web (2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur] (1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	6	
	Atmospheric Composition: Troposphere, Stratosphere,		

3	Mesosphere, Thermosphere, Tropopause and Mesopause (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L)	11	
4	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)	9	
5	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (3L)	3	

Course Outcome:

After completion of this course, the learners will be able to
1 understand the natural environment
2 understand relationships of natural environment with human activities
3 apply the fundamental knowledge of science and engineering to assess environmental and health risk
4 develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations
5 acquire skills for scientific problem-solving related to air, water, noise& land pollution.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MC-EE-401.CO1	-	2	-	-	-	3	3	3	_	_	_	3
MC- EE-401.CO2	1	-	-	-	-	3	3	3	-	-	-	3
MC- EE-401.CO3	-	1	-	-	-	3	3	3	-	-	-	3
MC- EE-401.CO4	-	2	-	-	-	3	3	3	-	-	-	3
MC-EE-401.CO5	1	2	2	-	2	3	3	3	-	-	-	3
Average	1	1.75	2	-	2	3	3	3	-	-	-	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Name of the course		**ELECTRIC MACHINE-II**	
Course Code: PC-EE-501		**Semester: 5th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the arrangement of windings of AC machines.		
2.	To understand the principle of production of pulsating and revolving magnetic fields.		
3.	To understand the principle of operation and characteristics of three phase Induction machines		
4.	To understand the principle of operation and characteristics of single phase Induction machines		
5.	To understand the principle of operation and characteristics of synchronous machine		
6.	To understand the principle of operation and characteristics of special electromechanical devices.		
7.	To solve problems of Induction machines, synchronous machines and special eletromechanical devices.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
3.	Electromagnetic field theory (PC-EE-303)		
4.	Electric Machine-I (PC-EE-401)		
Unit	**Content**	**Hrs**	**Marks**
1	**Fundamentals of AC machine windings:** Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single-turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis,3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding-concentrated and distributed, Sinusoidally distributed winding, winding distribution factor	5	
2	**Pulsating and revolving magnetic fields:** Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.	5	
3	**Induction Machines:** Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.	10	
	Single-phase induction motors:		

4	Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications	5	
5	**Synchronous machines:** Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.	10	
6	**Special Electromechanical devices:** Principle and construction of switched Reluctance motor, Permanent magnet machines, Brushless DC machines, Hysteresis motor, Stepper motor, Tacho generators.	5	

Course Outcome:

After completion of this course, the learners will be able to,

1. Describe the arrangement of winding of AC machines.
2. Explain the principle of operation of Induction machines, Synchronous machines and special machines.
3. Solve numerical problems of Induction machines, Synchronous machines and Special machines.
4. Estimate the parameters and efficiency of Induction machines and Synchronous machines.
5. Determine the characteristics of Induction machines and Synchronous machines and select appropriate methods for starting, braking and speed control of Induction machines.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE-501.CO1	3	3	3	2	2	2	-	-	-	-	-	2	3	3	-	2
PC-EE-501.CO2	3	3	3	3	2	2	-	-	-	-	-	2	3	3	-	2
PC-EE-501.CO3	3	3	3	3	2	2	-	-	-	-	-	2	3	3	-	2
PC-EE-501.CO4	3	3	3	3	2	2	-	-	-	-	-	1	3	3	-	2
PC-EE-501.CO5	3	3	3	3	2	2	-	-	-	-	-	2	3	3	-	2
Average	3	3	3	2.8	2	2	-	-	-	-	-	1.8	3	3	-	2

PO1: Engineering Knowledge
PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

Name of the course		**POWER SYSTEM-I**	
Course Code: PC-EE-502		**Semester: 5th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basic principle of generation of Electricity from different sources		
2.	To find parameters and characteristics of overhead transmission lines and cables.		
3.	To find different parameters for the construction of overhead transmission line		
4.	To determine the performance of transmission lines.		
5.	To understand the principle tariff calculation.		
6.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Circuit Theory (PC-EE-301)		
3.	Electromagnetic field theory (PC-EE-303)		
Unit	**Content**	**Hrs**	**Marks**
1	**Basic Concepts:** Evolution of Power System and present day Scenario. Structure of power system: Bulk power grid and Micro Grid. **Generation of Electric Power:** General layout of a typical coal fired power station, Hydro electric power station, Nuclear power station, their components and working principles, comparison of different methods of power generation. Introduction to Solar & Wind energy system. **Indian Electricity Rule-1956:** General Introduction.	10	
2	**Overhead transmission line:** Choice of frequency, Choice of voltage, Types of conductors, Inductance and Capacitance of a single phase and three phase symmetrical and unsymmetrical configurations. Bundle conductors. Transposition. Concept of GMD and GMR. Influence of earth on conductor capacitance. **Overhead line construction:** Line supports, Towers, Poles, Sag, Tension and Clearance, Effect of Wind and Ice on Sag. Dampers. **Corona:** Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential, Corona loss, advantages & disadvantages of Corona. Methods of reduction of Corona.	12	
3	**Insulators:** Types, Voltage distribution across a suspension insulator string, String efficiency, Arching shield & rings, Methods of improving voltage distribution across Insulator strings, Electrical tests on line Insulators.	05	

4	**Cables:** Types of cables, cable components, capacitance of single core & 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle.	04	
5	**Performance of lines:** Short, medium (nominal, T) and long lines and their representation. A.B.C.D constants, Voltage regulation, Ferranti effect, Power equations and line compensation, Power Circle diagrams.	06	
6	**Tariff:** Guiding principle of Tariff, different types of tariff.	03	

Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of generation of Electric power from different sources
2. determine parameters of transmission lines and its performance
3. explain the principle of formation of corona and methods of its reduction
4. conduct electrical tests on insulators
5. solve numerical problems related to overhead transmission line, cable, insulators and tariff

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PE-EE 502 .CO1	3	2	3	2	3	1	1	-	-	-	-	2	3	3	2	2
PE-EE 502.CO2	3	2	3	3	3	1	1	-	-	-	-	2	3	3	2	2
PE-EE 502.CO3	3	2	3	3	3	1	1	-	-	-	-	2	3	3	2	2
PE-EE 502.CO4	3	2	3	2	3	1	1	-	-	-	-	2	3	3	2	2
PE-EE 502.CO5	3	2	3	2	3	1	1	-	-	-	-	2	3	3	2	2
Average	3	2	3	2.4	3	1	1	-	-	-	-	2	3	3	2	2

PO1: Engineering Knowledge

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PO8: Ethics

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PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

Name of the course	**CONTROL SYSTEM**
Course Code: PC-EE-503	**Semester: 5th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam: 15 Marks
Tutorial: 0hr/week	Assignment & Quiz: 10 Marks
Practical: hrs./week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:	
1.	To find mathematical representation of LTI systems.
2.	To find time response of LTI systems of different orders
3.	To find the frequency response of LTI systems of different orders
4.	To understand stabilityof differentLTI systems.
5.	To analyze LTIsystems with state variables.
6.	To solve problems of mathematical modelling and stability of LTI systems

Pre-Requisite	
1.	Basic Electrical Engineering (ES-EE-101)
2.	Electric Circuit Theory (PC-EE-301)
3.	Electromagnetic field theory (PC-EE-303)
4.	Electric Machine-I (PC-EE-401)

Unit	**Content**	**Hrs**	**Marks**
1	**Introduction to control system:** Concept of feedback and Automatic control, Effects of feedback,Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts ofsensitivity and robustness. Types of control systems, Servomechanisms and regulators, examples offeedback control systems. Transfer function concept. Pole and Zeroes of a transfer function. Propertiesof Transfer function.	04	
2	**Mathematical modeling of dynamic systems:** Translational systems, Rotational systems, Mechanicalcoupling, Liquid level systems, Electrical analogy of Spring–Mass-Dashpot system. Block diagramrepresentation of control systems. Block diagram algebra. Signal flow graph. Mason's gain formula. Control system components: Potentiometer, Synchros, Resolvers, Position encoders. DC and ACtacho-generators. Actuators. Block diagram level description of feedback control systems for positioncontrol, speed control of DC motors, temperature control, liquid level control, voltage control of anAlternator.	08	
3	**Time domain analysis:** Time domain analysis of a standard second order closed loop system. Concept of undamped natural frequency, damping, overshoot, rise time and settling time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on transient response. Stability by pole location. Routh-Hurwitz criteria and applications. **Error Analysis:** Steady state errors in control systems due to step,	08	

	ramp and parabolic inputs. Concepts of system types and error constants.		
4	**Stability Analysis:** Root locus techniques, construction of Root Loci for simple systems. Effects ofgain on the movement of Pole and Zeros. **Frequency domain analysis of linear system:** Bode plots, Polar plots, Nichols chart, Concept ofresonance frequency of peak magnification. Nyquist criteria, measure of relative stability, phase andgain margin. Determination of margins in Bode plot. Nichols chart. M-circle and M-Contours inNichols chart.	10	
5	**Control System performance measure:** Improvement of system performance through compensation. Lead, Lag and Lead- lag compensation, PI, PD and PID control.	05	
6	**State variable Analysis:** Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.	10	

Course Outcome:

After completion of this course, the learners will be able to

1. develop mathematical model of mechanical, electrical, thermal, fluid system and different control system components like servomotors, synchros, potentiometer, tacho-generators etc.
2. analyse stability of LTI system using routh-hurtwitz (RH) criteria, root locus techniques in time domain and bode plot and nyquist technique in frequency domain.
3. design different control law or algorithms like proportional control, proportional plus derivative(PD) control, proportional plus integration(PI) control, and proportional plus integration plus derivative (PID) control and compensators like lag, lead, lag-lead for LTI systems.
4. apply state variable techniques for analysis of linear systems and analyze the stability of linear discrete system.
5. solve numerical problems on LTI system modelling, responses, error dynamics and stability .

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-503.CO1	3	3	3	2	-	2	2	2	2	2	-	3	3	2	-	2
PC-EE-503.CO2	3	3	3	3	2	2	1	2	2	1	-	2	3	2	-	2
PC-EE-503.CO3	3	3	3	3	-	2	2	2	1	2	-	2	3	2	2	2

PC-EE-503.CO4	3	2	3	2	-	2	1	1	2	2	-	1	3	3	1	2
PC-EE-503.CO5	3	3	3	2	-	2	1	2	2	2	-	2	3	3	2	2
Average	3	2.8	3	2.4	2	2	1.4	1.8	1.8	1.9	-	2	3	2.4	1.67	2

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Program Specific Outcomes (PSOs):

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PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**POWER ELECTRONICS**
Course Code: PC-EE-504	**Semester: 5th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam: 15 Marks
Tutorial: 0hr/week	Assignment & Quiz: 10 Marks
Practical: hrs./week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:

1.	To understand the functioning and characteristics of power switching devices.
2.	To understand the principle of operation of converters.
3.	To understand different triggering circuits and techniques of commutation of SCR
4.	To find external performance parameter of converters.
5.	To analyze methods of voltage control, improvement of power factor and reduction of harmonics of the converter
6.	To solve numerical problems of converters

Pre-Requisite

1.	Electric Circuit Theory (PC-EE-301)
2.	Analog Electronics (PC-EE-302)
3.	Electromagnetic field theory (PC-EE-303)
4.	Digital Electronics (PC-EE-402)

Unit	Content	Hrs	Marks
1	**Introduction:** Concept of power electronics, application of power electronics, uncontrolled converters,advantages and disadvantages of power electronics converters, power electronics systems,power diodes, power transistors, power MOSFETS, IGBT and GTO.	04	
2	**PNPN devices:** Thyristors, brief description of members of Thyristor family with symbol, V-Icharacteristics and applications. Two transistor model of SCR, SCR turn on methods,switching characteristics, gate characteristics, ratings, SCR protection, series and paralleloperation, gate triggering circuits, different commutation techniques of SCR.	05	
3	**Phase controlled converters:** Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, R-L and RLE loads, effects of freewheeling diodes and source inductance on the performance of converters. External performance parameters of converters, techniques of power factor improvement, single phase and three phase dual converters	06	
	DC-DC converters:		

4	Principle of operation, control strategies, step up choppers, types of choppers circuits based on quadrant of operation, performance parameters, multiphase choppers.	05	
5	**Inverters:** Definition, classification of inverters based on nature of input source, wave shape of outputvoltage, method of commutation & connections. Principle of operation of single phase andthree phase bridge inverter with R and R-L loads, performance parameters of inverters,methods of voltage control and harmonic reduction of inverters.	10	
6	**Resonant Pulse Converters:** Introduction, Series Resonant inverter, Parallel Resonant inverter, Zero-Current Switching Resonant converters, Zero-Voltage Switching Resonant converter, Two quadrant Zero-Voltage Switching Resonant converter, Resonant DC link inverter.	05	
7	**Applications:** Speed control of AC and DC motors. HVDC transmission. Static circuit breaker, UPS,static VAR controller.	05	

Course Outcome:

After completion of this course, the learners will be able to

1. differentiate between signal level and power level devices.
2. construct triggering and commutation circuits of SCR..
3. explain the principle of operation of AC-DC, DC-DC and DC-AC converters.
4. Analyze the performance of AC-DC, DC-DC and DC-AC converters
5. apply methods of voltage control and harmonic reduction to inverters.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-504-CO1	3	-	-	-	-	-	-	-	-	-	-	1	1	1	-	1
PC-EE-504-.CO2	3	3	3	2	2	2	1	2	2	1	-	2	3	2	-	2
PC-EE-504-CO3	3	3	3	2	-	2	1	2	1	2	-	2	3	2	2	2
PC-EE-504-CO4	3	2	3	2	-	2	1	1	2	2	-	1	3	3	1	2
PC-EE-504-CO5	3	3	3	2	-	2	1	2	2	2	-	2	3	3	2	2
Average	3	2.75	3	2	2	2	1	1.8	1.8	1.9	-	2	3	2.4	1.67	2

PO1: Engineering Knowledge
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PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course		**OBJECT ORIENTED PROGRAMMING**	
Course Code: OE-EE-501B		**Semester: 5th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Practical: hrs./week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand simple abstract data types		
2.	To understand features of object-oriented design such as encapsulation, polymorphism, Inheritance		
3.	To understand common object-oriented design patterns		
4.	To design applications with an event-driven graphical user interface.		
Pre-Requisite			
1.	Programing for problem solving (ES-CS 201)		
Unit	**Content**	**Hrs**	**Marks**
1	Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.	08	
2	Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance.	08	
3	Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern.	08	
4	Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.	08	
5	Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process	08	

Course Outcome:

After completion of this course, the learners will be able to

1. specify simple abstract data types.
2. recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. apply common object-oriented design patterns
4. specify uses of common object oriented design patterns with examples.
5. design applications with an event-driven graphical user interface.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
OE-EE-501B .1	3	3	3	2	2	3	2	2	3	3	3	3	2	3	2	2
OE-EE-501B .2	3	2	3	1	2	3	3	3	2	3	-	3	1	3	1	3
OE-EE-501B .3	2	3	2	-	2	2	1	-	3	-	3	2	2	-	2	2
OE-EE-501B .4	3	1	3	2	2	1	-	2	2	3	2	-	2	3	2	-
OE-EE-501B .5	3	-	3	3	2	3	3	3	3	2	3	3	3	2	3	2
Average	2.8	1.8	2.8	1.6	2	2.4	1.8	2	2.6	2.2	2.2	2.2	2	2.2	2	1.8

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PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

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PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

Name of the course	**POWER PLANT ENGINEERING**
Course Code: PE-EE-501B	**Semester: 5th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester Exam: 15 Marks
Tutorial: 0hr/week	Assignment & Quiz: 10 Marks
Practical: hrs./week	Attendance: 05 Marks
Credit Points: 3	End Semester Exam: 70 Marks

Objective:			
1.	To understand methods of selection of power plant and its economic.		
2.	To understand the principle of operation different types of power plants.		
3.	Tounderstand methods of site selection of different power plants.		
4.	To understand the cause of pollution and its remedy for power plants.		
5.	To understand methods of cooling of generators and transformers.		
6.	To solve numerical problems of load estimation, economics of power plants.		
Pre-Requisite			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Electromagnetic field theory (PC-EE-303)		
3.	Electric Machine-I (PC-EE-401)		
4.	Electrical and Electronics measurement (PC-EE-403)		
Unit	**Content**	**Hrs**	**Marks**
1	**Introduction:** Power and energy, sources of energy, review of thermodynamic cycles related to powerplants, fuels and combustion calculations.Load estimation, load curves, various terms and factors involved in power plantcalculations. Effect of variable load on power plant operation, Selection of power plant. **Power plant economics and selection**: Effect of plant type on costs, rates, fixed elements, energy elements, customer elements andinvestor's profit; depreciation and replacement, theory of rates. Economics of plantselection, other considerations in plant selection.	08	
2	**Steam power plant:** General layout of steam power plant, Power plant boilers including critical and supercritical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systemssuch as coal handling system, pulverizers and coal burners, combustionsystem, draft, ash handling system, Dust collection system, Feed water treatment andcondenser and cooling towers and cooling ponds, Turbine auxiliary systems such asgoverning, feed heating, reheating, flange heating and gland leakage. Operation andmaintenance of steam power plant, heat balance and efficiency, Site selection of a steampower plant.	08	
	Diesel power plant:		

3	General layout, Components of Diesel power plant, Performance of diesel power plant, fuelsystem, lubrication system, air intake and admission system, supercharging system, exhaustsystem, diesel plant operation and efficiency, heat balance, Site selection of diesel powerplant, Comparative study of diesel power plant with steampower plant. **Gas turbine power plant:** Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels,cogeneration, auxiliary systems such as fuel, controls and lubrication, operation andmaintenance, Combined cycle power plants, Site selection of gas turbine power plant .	08	
4	**Nuclear power plant:** Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants. **Hydro electric station:** Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems. **Non Conventional Power Plants:** Introduction to non-conventional power plants (Solar, wind, geothermal, tidal)etc.	10	
5	**Electrical system:** Generators and their cooling, transformers and their cooling.Instrumentation Purpose, classification, selection and application, recorders and their use,listing of various control rooms.Pollution due to power generation and its remedy	06	

Course Outcome:

After completion of this course,the learners will be able to

1. Explain the principle of operational of steam, Hydroelectric, Diesel, Gas turbine, Nuclear power and non-conventional power plant.
2. Identify the cause of pollution for power generation and its remedy.
3. Suggest location to set up Steam, Hydroelectric, Diesel, Gas turbine and Nuclear power plant.
4. Compare steam, Hydroelectric, Diesel, Gas turbine, Nuclear power and non-conventionalpower plant.
5. Suggest methods of maintenance of Steam, Gas and Hydroelectric power plants and solve numerical problems of load estimation and economics of power plants.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PE-EE-501B .CO1	3	2	3	2	3	2	3	-	-	-	-	3	3	2	2	2
PE-EE-501B .CO2	3	3	3	2	3	2	3	-	-	-	-	2	3	2	2	2
PE-EE-501B .CO3	3	3	3	2	3	2	3	-	-	-	-	2	3	2	2	2
PE-EE-501B .CO4	3	3	3	2	3	2	3	-	-	-	-	2	3	3	2	2
PE-EE-501B .CO5	3	3	3	2	3	2	3	-	-	-	-	2	3	3	2	2
Average	3	2.8	3	2	3	2	3	-	-	-	-	2.2	3	2.4	2	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

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Name of the course		**POWER SYSTEM-II**	
Course Code: PC-EE-601		**Semester: 6th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the method of representation of power system components		
2.	To know about loacation and components of a distribution substation.		
3.	To understand different methods of load flow studies.		
4.	To determine faults in Electrical systems.		
5.	To understand the principle of power system stability.		
6.	To understand the principle of relays and methods of protection of power system		
7.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Electric Circuit Theory (PC-EE-301)		
2.	Electromagnetic field theory (PC-EE-303)		
3.	Power system-I (PC-EE-502)		
Unit	Content	Hrs	Marks
1	**Representation of Power system components:** Single-phase representation of balanced three phase networks, the one-line diagram and the impedance or reactance diagram, per unit (PU) system.	02	
2	**Distribution substation:** Types of substations, location of substations, substation equipments and accessories, earthling (system & equipment), feeder and distributors, radial and loop systems.	05	
3	**Load flow studies:** Network model formulation, formation of Ybus, load flow problem, Gauss-Siedel method, Newton-Raphson method, Decoupled load flow studies, comparison of load flow methods.	05	
4	**Faults in Electrical systems:** Transient on a transmission line, short circuit of a synchronous machine under no load & loaded condition. Symmetrical component transformation, sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers. Symmetrical component analysis of unsymmetrical faults, single line-to –ground fault, lineto-line fault, double line-to- ground fault	08	
	Power system stability: Steady state stability, transient stability,		

5	equal area criteria, swing equation, multi machine stability concept	04	
6	**Power system protection:** Protective zones, Relaying elements and quantities. Protective relays, basic requirements and type of protection, phase and amplitude comparator, grading (time & current), classification of Electromagnetic relays, Directional relay, Distant relay, Differential relay, basic aspects of static and digital relays, relay protection scheme for transformer, feeder, generators and motors. Circuit breakers, circuit breaking transients, transient recovery voltage, current chopping and resistance switching, circuit breaker rating, arc and arc extinction, circuit breaker types, oil circuit breaker, vacuum circuit breaker, air blast circuit breaker, SF6 circuit breaker and operating mechanism, advantages and disadvantages of different types	12	

Course Outcome:

After completion of this course, the learners will be able to

1. Represent power system components in line diagrams.
2. Determine the location of distribution substation.
3. Determine the performance of power system with the help of load flow studies.
4. Analyze faults in Electrical systems.
5. Determine the stabilty of Power system.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-601.CO1	3	2	3	2	3	1	1	-	-	-	-	2	3	3	2	2
PC-EE-601.CO2	3	2	3	1	3	1	1	-	-	-	-	2	3	3	2	2
PC-EE-601.CO3	3	2	3	3	3	1	1	-	-	-	-	2	3	3	2	2
PC-EE-601.CO4	3	2	3	3	3	1	1	-	-	-	-	2	3	3	2	2
PC-EE-601.CO5	3	2	3	2	3	1	1	-	-	-	-	2	3	3	2	2
Average	3	2	3	2.2	3	1	1	-	-	-	-	2	3	3	2	2

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Name of the course	**MICROPROCESSOR & MICRO CONTROLLER**
Course Code: PC-EE-602	**Semester: 6th**
Duration: 6months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15Marks
Tutorial: 0hr/week	Assignment & Quiz: 10Marks
Credit Points: 3	Attendance: 05Marks
	End Semester Exam: 70 Marks

Objective:	
1.	To understand the architecture of 8086 microprocessor.
2.	To understand the design aspects of I/O and Memory Interfacing circuits.
3.	To interface microprocessors with supporting chips.
4.	To understand the architecture of 8051 microcontroller.
5.	To design a microcontroller based system
Pre-Requisite	
1.	Analog Electronics (PC-EE-302)
2.	Digital Electronics (PC-EE-402)

Unit	Content	Hrs
1	**The 8086 Microprocessor:** Introduction to 8086- Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte andString Manipulation.	08
2	**8086 System bus structure:** 8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.	08
3	**I/O INTERFACING**: Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller –DMA controller – Programming and applications Case studies: Traffic Light control, LED display ,LCD display, Keyboard display interface and Alarm Controller.	08
4	**Microcontroller:** Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.	08
5	**Interfacing Microcontroller:** Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – ExternalMemory Interface-StepperMotorandWaveformgeneration–Comparison	06

	of Microprocessor, Microcontroller, PIC and ARM processors	

Course Outcome:

After completion of this course, the learners will be able to

1. explain the architecture of 8086 and8051.
2. do assembly language programming of 8086, 8051
3. interface different peripheral with 8086 and 8051
4. develop micro processor/ microcontroller based systems.
5. compare microprocessor, microcontroller, PIC and ARM processors

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO 5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-602.CO1	3	3	3	2	-	1	-	-	3	3	-	1	3	1	-	3
PC-EE-602.CO2	3	3	3	3	-	1	-	-	3	3	-	3	3	3	2	3
PC-EE-602.CO3	3	3	3	3	-	2	-	-	3	3	-	3	3	3	2	3
PC-EE-602.CO4	3	2	3	3	3	3	-	-	3	2	-	3	3	3	2	3
PC-EE-602.CO5	3	3	3	3	3	3	-	-	3	2	-	2	3	3	3	3
Average	3	2.8	3	2.8	3	2	-	-	3	2.6	-	2.4	3	2.6	2.2	3

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Name of the course		**DIGITAL CONTROL SYSTEM**	
Course Code: PE-EE-601A		**Semester: 6th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the principle of sampling and reconstruction of signals.		
2.	To find Z-tranaform and inverse Z-transform of systems.		
3.	To carry out the analysis and design of digital control systems		
4.	To design compensators for digital control system to achieve desired specifications.		
5.	To represent digital control systems using state space models.		
6.	To analyze the effect sampling on stability, controllability and observability.		
7.	To design digital controllers for industrial applications.		
8.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Control system (PC-EE-503)		
Unit	Content	Hrs	Marks
1	**Sampling and reconstruction:** Introduction, Examples of Data control systems – Digital to Analog conversion and Analog to Digital conversion, sample and hold operations.	03	
2	**Z-transform:** Introduction, Linear difference equations, pulse response, Z – transforms, Theorems of Z – Transforms, the inverse Z – transforms, Modified Z- Transforms	05	
3	**Z- Plane analysis of discrete-time control system:** Z-Transform method for solving difference equations; Pulse transforms function, block diagram analysis of sampled – data systems, mapping between s-plane and z-plane.	05	
4	**State space analysis:** State Space Representation of discrete time systems, Pulse Transfer Function Matrix solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations.	06	
5	**Controllability and observability:** Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function	04	
6	**Stabilty analysis:** Mapping between the S-Plane and the Z-Plane – Primary strips and Complementary Strips – Constant frequency loci, Constant damping ratio loci, Stability Analysis of	05	

	closed loop systems in the Z-Plane. Jury stablility test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.		
7.	**Design of discrete time control system by conventional methods:** Transient and steady – State response Analysis – Design based on the frequency response method – Bilinear Transformation and Design procedure in the w-plane, Lead, Lag and Lead-Lag compensators and digital PID controllers.	06	
8.	**State feedback controllers and observers:** Design of state feedback controller through pole placement – Necessary and sufficient conditions, Ackerman's formula. State Observers – Full order and Reduced order observers.	05	

Course Outcome:

After completion of this course, the learners will be able to

1. explain the principle of sampling and reconstrction of analog signal.
2. perform Z-transformation and inverse Z-tranaformation of systems.
3. analyse and design digital control systems. design compensators for digital control system to achieve desired specifications.
4. represent digital control systems using state space models.
5. analyze the effect sampling on stability, controllability and observability.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PE-EE-601A .CO1	2	2	2	2	-	2	2	2	2	2	-	3	3	2	-	2
PE-EE-601A .CO2	3	3	3	3	2	2	1	2	2	1	-	2	3	2	-	2
PE-EE-601A .CO3	3	3	3	3	-	2	2	2	1	2	-	2	3	2	2	2
PE-EE-601A .CO4	3	2	3	2	-	2	1	1	2	2	-	1	3	3	1	2
PE-EE-601A .CO5	3	3	3	2	2	2	1	2	2	2	-	2	3	3	2	2
Average	2.8	2.6	2.8	2.4	2	2	1.4	1.8	1.8	1.9	-	2	3	2.4	1.67	2

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Name of the course	**ELECTRICAL MACHINE DESIGN**
Course Code: PE-EE-601C	**Semester: 6th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10 Marks
Credit Points: 3	Attendance: 05 Marks
	End Semester Exam: 70 Marks

Objective:	
1.	To understand the baisc principle of design of Electric machines.
2.	To understand basics of design of Transformer, Induction machine and Synchronous machines.
3.	To understand different factors that influence design of Electric machines.
4.	To undertand the need and use software tools for design of Electric machines
5.	To solve numerical problems on the topics studied
Pre-Requisite	
1.	Electric Machine-I (PC-EE-401)
2.	Electric Machine-II (PC-EE-501)

Unit	Content	Hrs	Marks
1	**Introduction:** Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow – Temperature rise and Insulating Materials - Rating of machines – Standard specifications.	04	
2	**Transformer:** Output Equations – Main Dimensions - kVA output for single and three phase transformers – Window space factor – Design of core and winding – Overall dimensions – Operating characteristics – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.	10	
3	**Induction motors:** Output equation of Induction motor – Main dimensions – Choice of Average flux density – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Operating characteristics- Losses and Efficiency.	10	

4	**Synchronous machines:** Output equations – choice of Electrical and Magnetic Loading – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.	10	
5	**Computer aided Design (CAD):** Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation	05	

Course Outcome:

After completion of this course, the learners will be able to

1. specify the rating of electrical machines with standard specifications.
2. explain the principles of electrical machine design and carry out basic design of an ac machine
3. determine the various factors which influence the design of electrical, magnetic and thermal loading of electrical machines
4. explain the construction and performance characteristics of electrical machines.
5. use software tools to do design calculations.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PE-EE-601C.CO1	3	3	3	2	-	2	2	2	2	2	-	3	3	2	-	2
PE-EE-601C.CO2	3	3	3	3	2	2	1	2	2	1	-	2	3	2	-	2
PE-EE-601C.CO3	3	3	3	3	-	2	2	2	1	2	-	2	3	2	2	2
PE-EE-601C.CO4	3	2	3	2	-	2	1	1	2	2	-	1	3	3	1	2
PE-EE-601C.CO5	3	3	3	2	-	2	1	2	2	2	-	2	3	3	2	2
Average	3	2.8	3	2.4	2	2	1.4	1.8	1.8	1.9	-	2	3	2.4	1.67	2

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Name of the course		**INDUSTRIAL ELECTRICAL SYSTEMS**	
Course Code: PE-EE-602C		**Semester: 6th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the electrical wiring systems with standard symbols , drawings and SLD for residential, commercial and industrial consumers		
2.	To understand various components of industrial electrical systems		
3.	To analyze and select the proper size of various electrical system components		
4.	To understand methods of automation of Industrial Electrical Systems		
5.	To solve numerical problems on the topics studied		
Pre-Requisite			
1.	Power system-I (PC-EE-502)		
2.	Control system (PC-EE-503)		
3.	Power Electronics (PC-EE-504)		
Unit	Content	Hrs	Marks
1	**Electrical System Components:** LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices	06	
2	**Residential and Commercial Electrical Systems** :Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.	08	
3	**Illumination Systems** : Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.	06	
	Industrial Electrical Systems I: HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting		

4	of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.	06	
5	**Industrial Electrical Systems II:** DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.	06	
6.	**Industrial Electrical System Automation**: Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.	06	

Course Outcome:

After completion of this course, the learners will be able to

1. Represent electrical wiring system for residential, commercial and industrial consumers.
2. Determine the rating of components of residential and commercial electrical systems.
3. Design lighting scheme for a residential and commercial premises.
4. Select transformer, switchgear, protection equipments for industrial electrical systems.
5. Explain methods of automation of Industrial Electrical Systems and Solve numerical problems related to earthing system, lighting scheme, power factor correction.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PE-EE-602C .CO1	3	3	3	2	-	2	2	2	2	2	-	3	3	2	-	2
PE-EE-602C .CO2	3	3	3	3	2	2	1	2	2	1	-	2	3	2	-	2
PE-EE-602C .CO3	3	3	3	3	-	2	2	2	1	2	-	2	3	2	2	2
PE-EE-602C .CO4	3	2	3	2	-	2	1	1	2	2	-	1	3	3	1	2
PE-EE-602C .CO5	3	3	3	2	-	2	1	2	2	2	-	2	3	3	2	2
Average	3	2.8	3	2.4	2	2	1.4	1.8	1.8	1.9	-	2	3	2.4	1.67	2

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PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

Name of the course	**DIGITAL SIGNAL PROCESSING**
Course Code: OE-EE-601A	**Semester: 6th**
Duration: 6months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15Marks
Tutorial: 0 hr/week	Assignment & Quiz: 10Marks
Credit Points: 3	Attendance: 05Marks
	End Semester Exam: 70 Marks

Objective:	
1.	To understand sampling and reconstruction of signal
2.	To understand the method of Z-transform and inverse Z- transform of signal and its properties
3.	To understand Discrete Fourier Transform
4.	To understand methods of design of Digital filters
5.	To understand applications of Digital signal processing
6.	To solve numerical problems on the topics studied
Pre-Requisite	
1.	Electric circuit theory (PC-EE-301)
2.	Control system(PC-EE-503)

Unit	Content	Hrs
1	**Discrete-time signals and systems:** Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.	06
2	**Z-transform:** z-Transform, Region of convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z- transforms.	06
3	**Discrete Fourier Transform :**Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.	08
4	**Design of Digital filters:** Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Bandstop and High- pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectralestimation. Introduction to multi-rate signal processing	12
5	**Applications of Digital Signal Processing:** Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.	06

Course Outcome:

After completion of this course, the learners will be able to

1. represent signals mathematically in continuous and discrete-time and in the frequency domain.
2. analyse discrete-time systems using z-transform.
3. explain the Discrete-Fourier Transform (DFT) and the FFT algorithms.
4. design digital filters for various applications.
5. apply digital signal processing for the analysis of real-life signals.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
OE-EE-601A. CO1	3	3	2	1	-	-	-	-	2	2	-	1	3	2	-	2
OE-EE-601A.CO2	3	3	3	2	1	-	-	-	2	2	-	1	3	3	-	2
OE-EE-601A.CO3	3	3	3	3	1	-	-	-	2	2	-	1	3	3	-	2
OE-EE-601A.CO4	3	3	3	3	-	2	-	-	2	2	-	2	3	3	1	2
OE-EE-601A.CO5	3	3	3	3	2	3	-	-	2	2	-	2	3	3	2	2
Average	3	3	2.8	2.4	1.3	2.5	-	-	2	2	-	1.4	3	2.8	1.5	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

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PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course		**ECONOMICS FOR ENGINEERS**	
Course Code: HM-EE-601		**Semester: 6th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Credit Points: 3		Attendance: 05 Marks	
		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the process of economic decision making		
2.	To understand th basic financial management aspects		
3.	To develop the skills to analyze financial statements		
4.	To understand the basic of accounting		
Pre-Requisite			
1.	Basic understanding of Engineering processes		
Unit	Content	Hrs	Marks
1	Economic Decisions Making – Overview, Problems, Role, Decision making process. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - PerUnit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	06	
2	Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value Of Money, Debt repayment, Nominal & Effective Interest. Present Worth Analysis : End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate Of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.	10	
3	Uncertainty In Future Events - Estimates And Their Use In Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation	10	

	Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.		
4	Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life Of A New Asset, Marginal Cost, Minimum Cost Life Problems. Inflation And Price Change – Definition, Effects, Causes, Price Change With Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.	08	
5	Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	06	

Course Outcome:

After completion of this course, the learners will be able to

1. evaluate the economic theories, cost concepts and pricing policies
2. explain the market structures and integration concepts
3. apply the concepts of financial management for project appraisal. explain accounting systems , the impact of inflation, taxation, depreciation
4. analyze financial statements using ratio analysis
5. explain financial planning, economic basis for replacement, project scheduling, legal and regulatory issues applied to economic investment and project-management problems.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HMEE601.CO1	2	1	-	-	-	1	-	-	-	-	1	2
HMEE601.CO2	2	-	1	-	-	1	-	-	-	-	1	2
HMEE601.CO3	2	3	2	-	-	-	-	-	-	-	2	2
HMEE601.CO4	2	2	1	-	-	-	-	2	-	-	-	2
HMEE601.CO5	2	3	2	2	-	2	-	1	-	-	2	2
Average	2	2.25	1.5	2	-	1.33	-	1.5	-	-	1.5	2

PO1: Engineering Knowledge

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PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

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PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Name of the course		**ELECTRIC DRIVE**	
Course Code: PC-EE 701		**Semester: 7^{th}**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand basic concept, classification and principle of operation of Electric Drive.		
2.	To understand methods of starting and braking of Electric Drive.		
3.	To understand methods of control of speed of DC and AC Drives.		
4.	To solve problem related to Electric Drive.		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Machine-I (PC-EE-401)		
3.	Electric Machine-II(PC-EE-501)		
Unit	Content	Hrs	Marks
1	**Electric Drive:** Concept, classification, parts and advantages of electrical dives. Types of Loads, Components of load toques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. Determination of moment of inertia, Steady state stability, Transient stability. Multi-quadrant operation of drives. Load equalization.	5	
2	**Motor power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors.	5	
3	**Stating of Electric Drives:** Effect of starting on Power supply, motor and load. Methods of stating of electric motors. Acceleration time, Energy relation during stating. Methods to reduce the Energy loss during starting. **Braking of Electric Drives:** Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking,	6	
4	**DC motor drives:** Modeling of DC motors**,** State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor	8	

	current. Chopper controlled DC motor drives. Closed loop control of DC Drives.		
5	**Induction motor drives:** Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control.	6	
6	**Synchronous motor drives:** Variable frequency control, Self Control, Voltage source inverter fed synchronous motor drive, Vector control.	5	
7	Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor drive **Industrial application:** Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.	5	

Course Outcome:
After completion of this course, the learners will be able to

1. Explain the principle of operation of electric drive.
2. Describe different methods of starting and braking of electric drive.
3. Model and control dc drive
4. Control speed of induction and synchronous motors.
5. Recommend drives for different applications and estimate ratings, variables and parameters of electric drives.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC EE701.CO 1	3	3	3	2	-	2	2	2	2	2	-	3	3	2	-	2
PC-EE701.CO 2	3	3	3	3	2	2	1	2	2	1	-	2	3	2	-	2
PC-EE701.CO 3	3	3	3	3	-	2	2	2	1	2	-	2	3	2	2	2
PC-EE701.CO 4	3	2	3	2	-	2	1	1	2	2	-	1	3	3	1	2
PC-EE701.CO 5	3	3	3	2	-	2	1	2	2	2	-	2	3	3	2	2
Average	3	2.8	3	2.4	2	2	1.4	1.8	1.8	1.9	-	2	3	2.4	1.67	2

PO1: Engineering Knowledge

PO2: Problem Analysis

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PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

Name of the course		**ELECTRICAL ENERGY CONSERVATION & AUDITING**	
Course Code: PE-EE 701B		**Semester: 7^{th}**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand the basic of energy resources, energy security, energy conservation and pollution.		
2.	To understand the energy management concepts.		
3.	To understand energy conservation principles and measures		
4.	To learn the methods of energy audit and usage of instruments		
Pre-Requisite			
1.	Basic Electrical Engineering (ES-EE-101)		
2.	Electric Machine (PC-EE-401, PC-EE-501)		
3.	Electric Power system (PC-EE-502, PC-EE-601)		
4.	Control System (PC-EE-503)		
Unit	Content	Hrs	Marks
1	**Energy Scenario:** Commercial and Non-commercial energy, Primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.	5	
2	**Basics of Thermal Energy management :** Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.	5	
3	**Energy Management & Audit:** Definition, energy audit, need, types of energy audit. Energy management (audit) approach, understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.	6	
4	**Energy Efficiency in Electrical Systems:** Electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Performance	8	

	assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.		
5	**Energy Efficiency in Industrial Systems:** Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.	10	
6	**Energy Efficient Technologies in Electrical Systems:** Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.	6	

Course Outcome:

After completion of this course, the learners will be able to

1. explain the basic of energy resources, energy security, energy conservation and pollution
2. quantify the energy conservation opportunities in different electrical and thermal systems
3. identify the common energy conservation opportunities in different energy intensive industrial equipments.
4. explain the methods of energy management and audit
5. analyze and report the outcome of energy audit.

PO-PSO / CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PE-EE 701B-CO1	3	1	-	1	-	2	2	3	2	2	-	3	3	2	-	2
PE-EE 701B-CO2	3	3	1	-	1	2	2	-	2	1	-	2	3	2	2	2
PE-EE 701B-CO3	3	3	2	2	2	2	2	-	2	2	-	2	3	2	2	2

PE-EE 701B-CO4	3	3	3	3	3	2	1	1	2	2	-	1	3	3	2	2
PE-EE 701B-CO5	3	3	3	3	3	2	1	2	2	2	-	2	3	3	3	2
Average	3	2.6	2.25	2.25	2.25	2	1.6	2	2	1.8	-	2	3	2.4	2.25	2

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PO6: The Engineer and Society

PO7: Environment and Sustainability

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Program Specific Outcomes (PSOs):

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Name of the course	**ARTIFICIAL INTELLIGENCE**
Course Code: OE-EE-701A	**Semester: 7th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0hr/week	Assignment & Quiz: 10 Marks
Credit Points: 3	Attendance: 05 Marks
	End Semester Exam: 70 Marks

Objective:

1.	To understand the basic concepts, theories and state-of-the-art techniques of artificial intelligence.
2.	To understand basic concepts and applications of machine learning.
3.	To learn the application of machine learning /A.I algorithms in the different fields of science, medicine, finance etc.

Pre-Requisite

1.	Programming for problem solving (ES-CS201)
2.	Mathematics (BS-M301)
3.	Data structure and algorithm(OE-EE-501A)

Unit	Content	Hrs	Marks
1	**Introduction:** Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. **Intelligent Agents**: Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. **Problem Solving:** Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	06	
2	**Search techniques**: Solving problems by Searching: problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. **Heuristic search strategies:** Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. **Adversarial search :** Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening	12	
3	**Knowledge & reasoning:** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation	05	

4.	**Using predicate logic:** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Probabilistic reasoning [4] Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy Logic	06	
5.	**Natural Language processing:** Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. **Learning:** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. **Expert Systems:** Representing and using domain knowledge, expert system shells, knowledge acquisition	08	

Course Outcomes:

1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
4. Acquire the knowledge of real world Knowledge representation.
5. Analyze and design a real world problem for implementation and understand the dynamic behaviour of a system and use different machine learning techniques to design AI machine and enveloping applications for real world problems.

CO/PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
OE-EE-701A.1	1	1	2	3	2	1	2	1	2	1	1	2	1	2	2	1
OE-EE-701A.2	2	2	2	1	3	2	1	0	1	2	1	1	2	1	2	2
OE-EE-701A.3	1	1	1	1	2	1	1	1	1	1	2	2	1	1	1	1
OE-EE-701A.4	1	0	2	3	2	0	1	0	2	2	1	1	1	1	1	2
OE-EE-701A.5	3	2	2	2	2	1	1	0	1	2	2	1	1	2	2	2

Average	1.6	1.5	1.8	2	2.2	1	1.3	1	1.5	1.5	1.4	1.4	1.2	1.4	1.6	1.6

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PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**DIGITAL IMAGE PROCESSING**
Course Code: OE-EE 702B	**Semester: 7th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0hr/week	Assignment & Quiz: 10 Marks
Credit Points: 3	Attendance: 05 Marks
	End Semester Exam: 70 Marks

Objective:	
1.	To understand fundamentals and mathematical transforms necessary for image processing.
2.	To understand the image enhancement techniques.
3.	To understand the image restoration procedures.
4.	To understand the image compression procedures.
Pre-Requisite	
1.	Digital Signal Processing (OE-EE 601A)

Unit	Content	Hrs	Marks
1	**Introduction:** Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.	08	
2	**Image Enhancement In The Spatial Domain**: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.	08	
3	**Image Enhancement In Frequency Domain:** Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.	08	
4	**Image Segmentation:** Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation-Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.	08	
5	**Image Compression:** Introduction, coding Redundancy , Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.	08	

Course Outcome:

After completion of this course, the learners will be able to

1. explain the fundamental concepts of a digital image processing system.
2. enhance images in the spatial and frequency domain using various transforms.
3. apply different image segmentation techniques.
4. categorize various compression techniques. implement image process and analysis algorithms.
5. apply image processing algorithms in practical applications.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
OE-EE 702B .CO1	2	2	-	-	-	2	2	2	-	2	-	3	3	2	-	2
OE-EE 702B .CO2	2	2	2	-	2	2	1	2	2	1	-	2	3	2	-	2
OE-EE 702B .CO3	3	3	3	3	-	2	2	2	1	2	-	2	3	2	2	2
OE-EE 702B .CO4	3	2	3	-	-	2	1	1	2	2	-	1	3	3	3	2
OE-EE 702B .CO5	3	3	3	2	2	2	1	2	2	2	-	2	3	3	3	2
Average	2.6	2.4	2.75	2.5	2	2	1.4	1.8	1.75	1.8	-	2	3	2.4	2.67	2

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Name of the course		**PRINCIPLE OF MANAGEMEENT**	
Course Code: HM-EE 701		**Semester: 7th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand basic concept and approaches to management.		
2.	To understand planning and decision making processes. .		
3.	To understand organizational design and structure.		
4.	To understand various aspects of leadership.		
Pre-Requisite			
1.	English (HM- HU 201)		
Unit	Content	Hrs	Marks
1	**Concept & approaches to management:** Meaning & Definition of the term Management, Management as a Science or an Art, Management as a Profession, Management as a Process, Difference between Management & Administration; Levels of Management, Roles of a Manager, Quality of a good Manager, Significance of Management, Limitations of Management, Business Environment and its interaction with Management. Approaches to Management – Classical, Neo-classical and Modern Contributors to Management Thought – Taylor and Scientific Theory, Fayol's and Administrative Theory, Peter Drucker and Management Thought. Various Approaches to Management (i.e. Schools of Management Thought) Indian Management Thought	8	
2	**Planning & decision making:** Planning: Meaning, Definition, Process, Types, Principles, Significance & Limitations of Planning; Strategic Planning – Meaning & Process, MBO – Meaning, Process and Requirements for Implementation, Planning Premises – Meaning & Types, Forecasting – Meaning & Techniques. Decision Making – Meaning, Types, Process, Significance & Limitations	8	
3	**Organization design & Structure:** Organization – Meaning, Process, Principles, Organization Structure – Determinants and Forms: Line, Functional, Line & Staff, Project, Matrix and Committees; Formal and Informal Organization; Departmentation – Meaning and Bases; Span of Control – Meaning and Factors Influencing; Authority, Responsibility and Accountability; Delegation – Meaning, Process; Principles; Centralization and Decentralization – Meaning; Degree	8	

	of Decentralization; Difference between Delegation And Decentralization.		
4	**Directing:** Motivation – Meaning , Definition, Significance & Limitations; Financial and non-financial incentives of Motivation Leadership - Meaning, Definition, Significance of Leadership, Leadership styles Type, Process and Barriers of Communication, Strategies to overcome the Barriers.	8	
5	**Customer Management** – Market Planning & Research, Marketing Mix, Advertising & Brand Management. **Operations & Technology Management** – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.	8	

Course Outcomes:

On completion of the course students will be able to

1. explain the concepts and approaches of management. demonstrate the roles, skills and functions of management.
2. diagnose and solve organizational problems.
3. identify the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities.
4. apply different methods of Customer, Operation and Technology management.
5. acquire skills of good leader in an organization.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HMEE701.CO1	-	-	-	-	-	-	-	2	1	1	-	3
HMEE701.CO2	-	-	-	-	-	-	-	1	2	3	1	3
HMEE701.CO3	-	-	-	-	-	-	-	-	3	3	2	3
HMEE701.CO4	-	-	-	-	-	-	-	2	2	3	3	3
HMEE701.CO5	-	-	-	-	-	-	-	-	3	3	-	2
Average	-	-	-	-	-	-	-	1.66	2	2.6	1	2.8

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Name of the course		**UTILIZATION OF ELECTRIC POWER**	
Course Code: PC-EE 801		**Semester: 8th**	
Duration: 6 months		**Maximum Marks: 100**	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks	
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks	
Practical: 0 hrs/week		Attendance: 05 Marks	
Credit Points: 3		End Semester Exam: 70 Marks	
Objective:			
1.	To understand basic principle of illumination and good lighting practices		
2.	To understand the method of Electric heating, Welding and Electrolytic processes.		
3.	To understand the concepts of Electrical traction systems .		
4.	To solve numerical problems on the topics studied.		
Pre-Requisite			
1.	Electric Machine (PC-EE-401, PC-EE-501)		
2.	Control System (PC-EE-503)		
3.	Power Electronics (PC-EE-504)		
Unit	Content	Hrs	Marks
1	**Electric Traction :** Requirement of an ideal traction system, Supply system for electric traction, Train movement (speed time curve, simplified speed time curve, average speed and schedule speed), Mechanism of train movement (energy consumption, tractive effort during acceleration, tractive effort on a gradient, tractive effort for resistance, power & energy output for the driving axles, factors affecting specific energy consumption, coefficient of adhesion). Electric traction motor & their control: Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply, Tractive effort and horse power. Use of AC series motor and Induction motor for traction. Traction motor control: DC series motor control, Multiple unit control, Braking of electric motors, Electrolysis by current through earth, current collection in traction system, Power electronic controllers in traction system.	10	
2	**Electric Lighting:** Definition of terms; laws of illumination; Luminaries; Lighting requirements; Illumination levels; lamp selection and maintenance; Lighting schemes, calculations & design – Interior lighting – industrial, Factory, residential lighting; Exterior lighting - Flood, street lighting, lighting for displays and signaling - neon signs, LED-LCD displays beacons and lighting for surveillance; Energy Conservation codes for lighting; lighting controls – daylight sensors and occupancy sensors; controller design.	8	
3	**Electric Heating :** Advantages of electrical heating, Heating methods, Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating	08	

	appliances and thermostat control circuit ,Induction heating; principle of core type and coreless induction furnace , Electric arc heating, direct and indirect arc heating, construction, working and applications of arc furnace, Dielectric heating, applications in various industrial fields, Infra-red heating and its applications, Microwave heating, Simple design problems of resistance heating element.		
4	**Electric Welding:** Advantages of electric welding, Welding methods, Principles of resistance welding, types –spot, projection seam and butt, welding and welding equipment used , Principle of arc production, electric arc welding, characteristics of arc, carbon arc, metal arc, hydrogen arc welding and their applications, Power supply required ,Advantages of using coated electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminum and copper, Introduction to TIG, MIG welding	08	
5	**Electrolytic processes:** Need of electro-deposition, Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing, buffing, Equipment and accessories for electroplating, Factors affecting electro-deposition, Principle of galvanizing and its applications, Principle of anodising and its applications, Electroplating on non-conducting materials, Manufacture of chemicals by electrolytic process and electrolysis process.	06	

Course Outcome:

After completion of this course, the learners will be able to

1. explain the fundamentals of illumination and different lighting schemes.
2. explain the fundamental of Electrolytic processes, Electric heating and Welding.
3. able to select appropriate lighting, heating and welding techniques for specific applications.
4. apply different electrolysis process for different applications.
5. explain the principle of different aspect of Electric traction and control of traction motor

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE 801-CO1	3	1	1	-	-	2	2	-	2	2	-	2	3	2	-	2
PC-EE 801-CO2	3	1	1	-	-	2	2	-	2	2	-	2	3	2	-	2
PC-EE 801-CO3	3	3	2	2	3	2	2	1	2	2	-	2	3	2	2	2
PC-EE 801-CO4	3	3	3	2	2	2	1	1	2	2	-	1	3	3	3	2
PC-EE 801-CO5	3	2	2	1	-	2	-	2	2	2	-	2	3	3	-	2

Average	3	2	1.8	1.67	2.5	2	1.75	1.33	2	2	-	1.8	3	2.4	2.5	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.
PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.
PSO3: Students will be aware about the latest technology in software and hardware.
PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course		**ADVANCED ELECTRIC DRIVE**
Course Code: PE-EE 801C		**Semester: 8th**
Duration: 6 months		**Maximum Marks: 100**
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs/week		Mid Semester Exam: 15 Marks
Tutorial: 0 hr/week		Assignment & Quiz: 10 Marks
Practical: 0 hrs/week		Attendance: 05 Marks
Credit Points: 3		End Semester Exam: 70 Marks
Objective:		
1.	To understand basic principle of operation of Power Converters used for AC drives	
2.	To understand the method for modeling and control of Induction motor and Synchronous motor.	
3.	To understand the method of control of Permanent magnet motor drive, Switched reluctance motor drive.	
4.	To understand the principle of DSP based motion control.	
Pre-Requisite		
1.	Electric Machine (PC-EE-401, PC-EE-501)	
2.	Control System (PC-EE-503)	
3.	Power Electronics (PC-EE-504)	

Unit	Content	Hrs	Marks
1	**Power Converters for AC drives:** PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.	8	
2	**Induction motor drives:** Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC).	8	
3	**Synchronous motor drives:** Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.	5	
4	**Permanent magnet motor drives:** Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.	5	
5	**Switched reluctance motor drives:** Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.	5	
6	**DSP based motion control:** Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.	5	

Course Outcome: After completion of this course, the learners will be able to

1. Explain the principle of operation of converters for ac drives.
2. Model induction and synchronous motor by reference frame theory.
3. Apply different control methods to control speed and torque of induction and synchronous motor.
4. Explain the configurations and method of speed control of bldc ,pmsm and srm.
5. Realize basic blocks for dsp based motion control and Develop appropriate scheme for speed control of induction and Synchronous motor.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PE-EE801C.CO1	3	2	3	2	3	1	1	-	-	-	-	2	3	3	3	3
PE-EE801C.CO2	3	2	3	3	3	1	1	-	-	-	-	2	3	3	3	3
PE-EE801C.CO3	3	2	3	3	3	1	1	-	-	-	-	2	3	3	3	3
PE-EE801C.CO4	3	2	3	2	3	1	1	-	-	-	-	2	3	3	3	3
PE-EE801C.CO5	3	2	3	2	3	1	1	-	-	-	-	2	3	3	3	3
Average	3	2	3	2.4	3	1	1	-	-	-	-	2	3	3	3	3

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Program Specific Outcomes (PSOs):

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PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

Name of the course	**SENSORS AND TRANSDUCERS**
Course Code: OE-EE 801D	**Semester: 8th**
Duration: 6 months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs/week	Mid Semester Exam: 15 Marks
Tutorial: 0hr/week	Assignment & Quiz: 10 Marks
Credit Points: 3	Attendance: 05 Marks
	End Semester Exam: 70 Marks

Objective:

1.	To understand the principle of operation of Transducers and Sensors
2.	To understand the application of Transducers and Sensors

Pre-Requisite

1.	Electric Circuit Theory (PC-EEE-301)
2.	Electromagnetic Field Theory (PC-EEE-303)

Unit	Content	Hrs	Marks
1	**Introduction**: Definition, significance of measurement and instruments. Principle of sensing & transduction, transducer classification, Transducer characteristics, emerging fields of sensor technologies.	05	
2	**Resistive transducers:** Potentiometers: types, loading error, metal and semiconductor strain gauges, types, resistance measuring methods, strain gauge applications: Load and torque measurement.	05	
3	**Inductive transducers:** Transformer type, synchros, eddy current transducers, LVDT: Construction, material, input-output characteristics. **Optical Sensors:** LDR, Photo Diode, Stroboscope, IR Sensor.	08	
4	**Capacitive transducers:** Variable distance-parallel plate type, variable area- parallel plate type, cylindrical type, differential type, variable dielectric constant type, calculation of sensitivity. Capacitive microphone, fluid level measurement. **Piezoelectric transducers:** piezoelectric effects, Materials, natural and synthetic types – their comparison, Charge and voltage co-efficient, Force and stress sensing, displacement measurement. **Magnetic Transducer:** Hall effect sensors, Magnetostrictive transducers: principle, positive and negative magnetostriction.	10	
5	**Thermal sensors:** Resistance temperature detector (RTD): principle, materials and types; Thermistor: principle, materials and types; Thermocouple, Thermoelectric effects, laws of thermocouple, thermocouple types, construction. IC temperature sensor, PTAT type sensor. **Radiation sensors:** types, characteristics and comparison. Pyroelectric type.	06	
6	**Micro-sensors and smart sensors:** Construction, characteristics and applications. Standards for smart sensor interface. **Recent Trends in Sensor Technologies:** Introduction; Film sensors (Thick film sensors, thin film sensor)	04	

Course Outcome:

After completion of this course, the learners will be able to

1. explain the basic principle of operation of Transducers and Sensors.
2. distinguish different sensors and transducers.
3. identify suitable transducer by comparing different industrial standards and procedures for measurement of physical parameters
4. estimate the performance of different transducers. design real life electronics and instrumentation measurement systems.
5. apply smart sensors, bio-sensors, PLC and Internet of Things to different applications.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
OE-EE 801D .CO1	2	1	-	-	-	2	2	2	-	2	-	2	3	1	-	2
OE-EE 801D .CO2	3	2	-	-	-	2	2	2	-	1	-	2	3	2	-	2
OE-EE 801D .CO3	3	3	-	1	-	2	2	2	1	2	-	2	3	2		2
OE-EE 801D .CO4	3	2	-	2	-	2	2	2	2	2	-	1	3	3	2	2
OE-EE 801D .CO5	3	3	3	-	-	2	2	2	2	2	-	2	3	3	2	2
Average	2.8	2.2	3	1.5	-	2	2	2	1.67	1.8	-	1.8	3	2.2	2	2

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Laboratory

Course Code : BS-CH191	**Category :** Basic Science Courses
Course Title : Chemistry-I Laboratory	**Semester** : First
L-T-P : **0-0-3**	**Credit:1.5**

Course Objectives:
To motivate students to understand the basic concepts of conductance, pH, electrochemical cells and its applications, measure Chloride ion and Dissolved Oxygen in given water sample, separation of mixtures, and study viscosity and partition coefficient.

Course Content:

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromateindicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. Saponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part

Course Outcomes:

1. Estimate the concentration of acid/alkali, cell constant by conductometric/ pH metric method using electrochemical cells.
2. Analyze different components from their mixtures by adsorption and TLC method.
3. Calculate the composition of given solution using Oswald Viscometer.
4. Determine rate constant for hydrolysis of ester by acid catalyzed and distribution coefficient of acetic acid between n-butanol and water
5. Determine the amount of chloride and dissolved oxygen present in a given water sample

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BS-CH191.CO1	2	2	2	-	2	2	2	-	-	-	-	2
BS-CH191.CO2	2	2	2	-	2	2	-	-	-	-	-	2
BS-CH191.CO3	-	-	2	-	-	2	-	-	-	-	-	2
BS-CH191.CO4	-	-	2	-	-	2	-	-	-	-	-	2
BS-CH191.CO5	-	2	2	-	-	2	2	-	-	-	-	2
Average	2	2	2		2	2	2	-	-	-	-	2

PO1: Engineering Knowledge
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Course Code : ES-EE191	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	**Semester** : First
L-T-P : **0-0-2**	**Credit: 1**
Pre-Requisites:	

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2. Introduction and uses of following instruments :
   (a) Voltmeter
   (b) Ammeter
   (c) Multimeter
   (d) Oscilloscope

Demonstration of real life resistors, capacitors with color code , inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronousmachine and single phase induction machine.
4. Calibration of ammeter and Wattmeter.
5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change involtage.
6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation ofimpedance and power factor.
7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8. (a) Open circuit and short circuit test of a single-phase transformer
   (b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shiftsbetween the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change ofphase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter forspeed control of an Induction motor
15. Demonstration of components of LT switchgear.

Course Outcomes

1. To understand basic safety precautions and instructions.
2. To understand the concept of calibration of ammeter and wattmeter, basics of active power and reactive power, balanced, unbalanced system and power measurement.
3. To understand steady state and transient response of R-L, R-C and R-L-C circuit, resonance frequency and quality factor.
4. To study open circuit and short circuit test of a single-phase transformer
5. To study the torque-speed characteristics of separately excited dc motor, induction motor and operating characteristics of synchronous generator.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-EE191.CO1	3	3	3	2	3	3	3	2	3	3	-	3	3	3	3	3
ES-EE191.CO2	3	3	2	2	3	3	2	-	-	-	-	3	3	3	3	3

ES-EE191.CO 3	3	3	3	2	3	3	2	-	-	-	-	3	3	3	3	3
ES-EE191.CO 4	3	3	3	1	3	3	-	-	-	-	-	3	3	3	3	3
ES-EE191.CO 5	3	3	3	1	3	3	-	-	-	-	-	3	3	3	3	3
Average	3	3	3	1.6	3	3	2.3	2	3	3	-	3	3	3	3	3

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Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

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PSO4: Students will be able to function effectively in multi-disciplinary field

Subject Code: ES-ME 191	Category: Engineering Science Courses
Subject Name: Engineering Graphics & Design	Semester: 1st
L-T-P: 1-0-4	Credit: 3
Prerequisite:	

Course Objective

Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

Course Syllabus

Module No.	Content	Lecture (L)	Practical (P)
1	**INTRODUCTION TO ENGINEERING DRAWING** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	**LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales.	1	4
3	**GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral.	1	4
4	**PROJECTION OF POINTS, LINES, SURFACES** Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1	4
5	**PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	**COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	**ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4
8	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
9	**OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION& CAD DRAWING** listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and	1	4

	automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;		
10	**ANNOTATIONS, LAYERING & OTHER FUNCTIONS** applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;	2	8
11	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid- modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modeling (BIM).	2	8

Course Outcome:

ES-ME 191.1: Introduction to engineering design and its place in society
ES-ME 191.2: Exposure to the visual aspects of engineering design
ES-ME 191.3: Exposure to engineering graphics standards
ES-ME 191.4: Exposure to solid modeling
ES-ME 191.5: Introduction to AutoCAD

CO-PO Mapping:

PO/PSO → Course outcome ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	P O8	P O 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
ES-ME 191.1	1	-	-	-	-	1	-	-	-	1	-	2	2	-	-	2
ES-ME 191.2	3	2	2	1	-	-	-	-	2	1	-	-	2	-	-	2
ES-ME 191.3	3	2	2	-	-	-	-	-	-	1	-	2	-	-	-	2
ES-ME 191.4	3	2	2	-	-	-	-	-	2	1	-	2	-	-	-	2
ES-ME 191.5	3	2	2	-	3	-	-	-	2	1	-	2	-	-	1	2
Average	2.6	2	2	1	3	1	-	-	2	1	-	2	2	-	1	2

PO1: Engineering Knowledge

PO2: Problem Analysis

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PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Course Code: ES-ME292	**Category:** Engineering Science Courses
Course Title: Workshop/ Manufacturing Practices	**Semester**: Second
L-T-P: **1-0-4**	**Credit:3**

Course Syllabus

(i) Lectures & videos:

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar or like.

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)
Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable. Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.
Simple wiring exercise to be executed to understand the basic electrical circuit. Simple soldering exercises to be executed to understand the basic process of soldering. Fabrication of a single-phase full wave rectifier with a step-down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

CO-PO Mapping:

Program outcomes/ PSO → / **Course ↓ outcome**	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	-	1	-	-	-	-	-	3	1	-	3	1	-	-	1
CO2	1	-	1	-	1	-	-	-	3	-	-	3	1	-	-	1
CO3	1	-	1	-	1	-	-	-	3	1	-	3	1	-	-	1
Avg	1	-	1	-	1	-	-	-	3	1	-	3	1	-	-	1

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PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program specific outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem-solving skills to analyze, design and develop economically feasible solutions for technical problems.

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PSO4: Students will be able to function effectively in multi-disciplinary field.

Course Code : BS-PH291	**Category :** Basic Science course
Course Title : Physics-I Laboratory	**Semester** : First/ Second
L-T-P : **0-0-3**	**Credit:1.5**

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and QuantumMechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of aphotovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variationof logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectralresponse of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and sheer force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity andto determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

Course Outcomes:

1. Analyses the physical properties of Light as well as the phenomenon of Dispersion to perceive concepts of modern optics.
2. Determine electrical and magnetic properties.
3. Measure some quantum mechanical constants.
4. Analyses the different parameter related to general properties of matter.
5. Determine the elastics and viscous properties.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSPH291.CO1	3	3	3	3	2	1	_	_	3	_	_	3
BSPH291.CO2	3	3	3	3	3	1	_	_	3	_	_	3
BSPH291.CO3	3	2	3	3	3	1	_	_	3	_	_	3
BSPH291.CO4	3	3	3	3	2	_	_	_	3	_	_	3
BSPH291.CO5	3	3	3	3	2	1	_	_	3	_	_	3
Average	3	2.8	3	3	2.4	1	_	_	3	_	_	3

PO1: Engineering Knowledge

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Course Code : HM HU 291	**Category :** Humanities and Social Sciences including Management Courses
Course Title : Language Laboratory	**Semester** : Second
L-T-P : **0-0-2**	**Credit: 1**

COURSE OBJECTIVE :

1. To help students develop basic proficiency in English Grammar, Vocabulary and Composition, and writing skills.
2. To help students identify common errors in writing and gain editing skills in the process.
3. To help students prepare a myriad of technical documents, including essays, precis', business letters, cover letters, CVs and emails in a practical setup.
4. To help students develop their conversation skills, linguistic skills and paralinguistic skills.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Honing 'Listening Skill' and its sub skills through Language Lab Audio device	3
2	Honing 'Speaking Skill' and its sub skills	2
3	Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech	2
4	Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode)	2
5	Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success	2
6	G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language,courtesies & other soft skills) of GD	4
7	Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non Technical Passages Learning Global / Contextual / Inferential Comprehension	2

Module No	Description of Topic	Contact Hrs.
1	Honing 'Listening Skill' and its sub skills through Language Lab Audio device	3
2	Honing 'Speaking Skill' and its sub skills	2
3	Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech	2
4	Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode)	2
5	Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success	2
6	G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language,courtesies & other soft skills) of GD	4
7	Honing 'Reading Skills' and its sub skills using Visual/ Graphics/ Diagrams/ Chat Display/ Technical/ Non Technical passages Learning Global/ Contextual/ Inferential Comprehension	2
8	Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions	2

Course Outcomes:
After completing this course, the students will be able to

1. **The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.**
2. **The student will be able to type effectively for recording technical documents.**
3. **The student will be able to develop appropriate body language and pronunciation.**
4. **The student will be able to effectively participate in debates and group discussions.**
5. **The student will be able to use computers and related software efficiently.**

CO/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

O												
HMHU 291.CO1	-	2	-	2	-	1	-	2	1	3	1	3
HMHU291.CO2	-	-	1	1	-	1	-	2	-	3	-	3
HMHU291.CO3	-	2	2	2	-	2	1	3	3	3	2	3
HMHU291.CO.4	-	2	1	-	-	-	1	3	2	3	-	3
HMHU291..CO.5	-	1	1	1	-	1	1	3	1	3	1	3
Average:	-	1.75	1.25	1.5	-	1.25	.75	2.8	1.75	3	1.33	3

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Subject Code: ES-CS291	*Category:* Engineering Science Courses
Subject Name: Programming for Problem Solving Lab	*Semester:* ***II***
L-T-P: : 3-0-0	*Credit:**3***

Course Objectives:

Learn preprogramming steps like writing algorithms, drawing flowcharts. Understand the structure, and learn the syntax and semantics of C programming .variable declaration with different data types and using operators. Concept of different control structures like decision control, loop control and special the concepts and advantages of using functions.¬ Understand the limitations of basic data types and concepts of derived. data types and user defined data types. Learn how to perform various FILE I/O.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	**Introduction to Programming** : Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) . Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory	*4*
2	Arithmetic expressions and precedence.	*2*
3	**Conditional Branching and Loops**: Writing and evaluation of conditionals and consequent branching . Iteration and loops	*6*
4	Arrays : Arrays (1-D, 2-D), Character arrays and Strings	*6*
5	Basic Algorithms : Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)	*6*
6	Function : Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference	*5*
7	Recursion : Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	*5*
8	Structure :Structures, Defining structures and Array of Structures	*4*
9	Pointers : Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list(no implementation)	*2*
10	File handling	*2*

Course Outcomes:

ES-CS291.1: To formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).

ES ES-CS291.2: To test and execute the programs and correct syntax and logical errors. To implement conditional branching, iteration and recursion.

ES-CS291.3:To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

ES-CS291.4: To use arrays, pointers and structures to formulate algorithms and programs. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

ES-CS291.5: To apply programming to solve simple numerical method problems, namely rot finding of function, Differentiation of function and simple integration

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
ES-CS291.1	2	3	1	1	1	1	2	3	-	2	3	1	2	2	1	2
ES-CS291.2	3	1	2	1	2	1	-	-	3	2	2	2	3	2	3	2
ES-CS291.3	1	3	1	2	2	-	2	3	3	2	3	2	2	-	3	-
ES-CS291.4	2	3	3	2	-	2	1	2	2	3	1	-	2	3	2	2
ES-CS291.5	3	3	2	2	2	2	1	-	3	3	2	3	3	3	2	3
Average	2.2	2.6	1.8	1.6	1.4	1.2	1.2	1.6	2.2	2.4	2.2	1.6	2.4	2.0	2.2	2.2

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Program specific outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem-solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course		**Electric circuit theory**
Course Code:PC-EE391		**Semester: 3rd**
Duration: 6 months		**Maximum marks:100**
Teaching Scheme		**Examination scheme:**
Theory: Nil		**Continuous Internal Assessment:40**
Tutorial: Nil		**External Assessment: 60**
Practical: 2 hrs/week		
Credit Points:1		
	Laboratory Experiments:	
1.	Transient response of R-L and R-C network: simulation with software & hardware	
2.	Transient response of R-L-C series and parallel circuit: simulation with software &hardware	
3.	Determination of Impedance (Z) and Admittance (Y) parameter of two-port network:simulation & hardware.	
4.	Frequency response of LP and HP filters: simulation & hardware.	
5.	Frequency response of BP and BR filters: simulation & hardware.	
6.	Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse,Ramp signal using MATLAB in both discrete and analog form.	
7.	Determination of Laplace transform and Inverse Laplace transform using MATLAB.	
8.	Amplitude and Phase spectrum analysis of different signals using MATLAB.	
9.	Verification of Network theorems using software & hardware	

Course Outcome: After completion of this course, the learners will be able to

1. determine
    - transient response of different electrical circuit
    - parameters of two port network
    - frequency response of filters.
    - Laplace transform and inverse Laplace transform
2. generate different signals in both discrete and analog form and analyze amplitude and phase spectrum of different signals.
3. verify network theorems.
4. construct circuits with appropriate instruments and safety precautions.
5. Simulate electrical circuit experiments using suitable software.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE 391.CO1	2	2	2	1	-	-	-	-	2	2	-	3	3	2	-	2
PC-EE 391.CO2	2	2	2	2	-	-	-	-	1	1	-	2	3	2	-	2
PC-EE 391.CO3	2	3	2	2	-	-	-	-	1	1	-	2	3	2	-	2
PC-EE 391.CO4	2	2	3	2	-	-	-	-	2	2	-	1	3	3	-	2
PC-EE 391.CO5	2	2	2	2	-	-	-	-	2	2	-	2	3	3	-	2
Average	2	2.2	2.2	1.8	-	-	-	-	1.6	1.6	-	2	3	2.4	-	2

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Program Specific Outcomes (PSOs):

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PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**Analog electronic laboratory**
Course Code:PC-EE392	**Semester: 3rd**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: Nil	**Continuous Internal Assessment: 40**
Tutorial: Nil	**External Assessment: 60**
Practical: 2 hrs/week	Credit Points:1

	Laboratory Experiments:
1.	Study of ripple and regulation characteristics of full wave rectifier with and without capacitor filter.
2.	Study of Zener diode as voltage regulator.
3.	Study of characteristics curves of B.J.T & F.E.T .
4.	Construction of a two-stage R-C coupled amplifier & study of it's gain & Bandwidth.
5.	Study of class A, C & Push-Pull amplifiers.
6.	Study of timer circuit using NE555 & configuration for monostable & astable and bistable multivibrator
7.	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip
8.	Construction of a simple function generator using IC.
9.	Realization of a V-to-I & I-to-V converter using Op-Amps.
10.	Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
11.	Study of D.A.C & A.D.C.

Course Outcome: After completion of this course, the learners will be able to

1. determine
   - characteristics of full wave rectifier with filter and without filter
   - characteristics of BJT and FET
   - characteristics of Zener diode as voltage regulator
   - characteristics of class A, C and push pull amplifiers
2. verify function of DAC and ADC
3. construct
   - function generator using IC
   - R-C coupled amplifier
   - linear voltage regulator using regulator IC chip.
   - timer circuit using 555 for monostable, astable and multistable multivibrator.
   - V to I and I to V converter with Op amps.

- phase locked loop using Voltage Controlled Oscillator (VCO)

4. work in a team
5. validate theoretical learning with practical

Special Remarks: The above-mentioned outcomes are not limited. Institute may redefine outcomes based their program educational objective.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC- PC-EE392.CO1	3	3	3	2	-	2	-	-	3	2	-	1	3	2	1	2
PC-EE392.CO2	3	3	3	2	-	1	-	-	3	3	-	1	3	2	1	2
PC-EE392.CO3	3	3	3	1	-	2	-	-	3	3	-	1	3	2	1	2
PC-EE392.CO4	3	3	3	2	-	3	-	-	3	3	-	1	3	3	1	3
PC-EE392.CO5	3	3	3	3	-	2	-	-	3	2	-	1	3	3	1	3
Average	3	3	3	2	-	2	-	-	3	2.6	-	1	3	2.4	1	2.4

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Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

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PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	Numerical Methods laboratory
Course Code: PC-CS 391	**Semester: 3rd**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: Nil	**Continuous Internal Assessment:40**
Tutorial: Nil	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

	Laboratory Experiments:
1.	Assignments on Newton forward /backward, Lagrange's interpolation.
2.	Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3.	Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations
4.	Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5.	Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.
6.	Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

Course Outcome: -

After completion of this course, the learners will be able to

1. Solve the complex problems of engineering on Interpolation using the programming language
2. Solve the complex problems of engineering on Numerical Integration using the programming language
3. Solve the complex problems of engineering on system of linear equations using the programming language
4. Solve the complex problems of engineering on the Transcendental equation using the programming language
5. Solve the complex problems of engineering on Ordinary Differential Equation using the programming language

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PCC-CS391.CO1	2	3	3	2	1	_	_	_	1	1	_	2
PCC-CS391.CO2	2	3	3	2	1	_	_	_	1	1	_	2
PCC-CS391.CO3	2	3	3	2	1	_	_	_	1	1	_	2
PCC-CS391.CO4	2	3	3	2	1	_	_	_	1	1	_	2
PCC-CS391.CO5	2	3	3	2	2	1	_	_	1	1	_	2

Average	2	3	3	2	1.2	1	_		1	1	_	2

PO1: Engineering Knowledge

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PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Name of the course	ELECTRIC MACHINE-I LABORATORY
Course Code: PC-EE491	**Semester: 4th**
Duration: 6months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0 hr./week	**Continuous Internal Assessment:40**
Tutorial: 0hr/week	**External Assessment: 60**
Practical:2 hrs./week	
Credit Points: 1	

	Laboratory Experiments:
1	Determination of the characteristics of a separately excited DC generator.
2	Determination of the characteristics of a DC motor
3	Study of methods of speed control of DC motor
4	Determination of the characteristics of a compound DC generator (short shunt)
5	Determination of speed of DC series motor as a function of load torque.
6	Polarity test on a single phase transformer
7	Determination of equivalent circuit of a single phase transformer and efficiency.
8	Study of different connections of three phase transformer.
9	Study of Parallel operation of a single phase transformers.
10	Determination of temperature rise and efficiency of the transformer.(Back to back test)

Course outcome: After completion of this course, the learners will be able to
1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions
4. validate different characteristics of DC machine , methods of speed control of DC motor and parallel operation of the transformer
5. work effectively in a team

CO \ PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE491.CO1	3	-	-	-	-	1	-	-	2	-	-	3	3	2	-	2
PC-EE491.CO2	3	2	-	1	2	1	-	-	2	-	-	3	3	2	2	2
PC-EE491.CO3	3	3	2	1	2	2	-	-	2	-	-	2	3	2	2	2
PC-EE491.CO4	3	2	3	2	2	2	-	-	2	-	-	1	3	3	2	2
PC-EE491.CO5	3	3	3	2	2	2	-	-	2	-	-	2	3	3	1	2
Average	3	2.5	2.67	1.5	2	1.6	-	-	2	-	-	2.2	3	2.4	1.75	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):
PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.
PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.
PSO3: Students will be aware about the latest technology in software and hardware.
PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**DIGITAL ELECTRONICS LABORATORY**
Course Code:PC-EE492	**Semester: 4th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 0 hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

	Laboratory Experiments:
1.	Realization of basic gates using Universal logic gates.
2.	Code conversion circuits- BCD to Excess-3 & vice-versa.
3.	.4-bit parity generator & comparator circuits.
4.	Construction of simple Decoder & Multiplexer circuits using logic gates.
5.	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display usingmultiplexer.
6.	Construction of simple arithmetic circuits-Adder, Subtractor.
7.	Realization of RS-JK & D flip-flops using Universal logic gates.
8.	Realization of Universal Register using JK flip-flops & logic gates.
9.	Realization of Universal Register using multiplexer & flip-flops.
10.	Construction of Adder circuit using Shift Register & full Adder.
11.	Realization of Asynchronous Up/Down counter
12.	Realization of Synchronous Up/Down counter
13.	Design of Sequential Counter with irregular sequences.

14.	Realization of Ring counter & Johnson's counter.
15.	Familiarization with A/D and D/A circuits

Course Outcome:

After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment and test the instruments for application to the experiment
2. construct decoder , multiplexer, adder and subtractor circuits with appropriate instruments and precaution
3. realize RS-JK and D flip flop, universal register with gates, multiplexer and flip-flops andasynchronous and synchronous up down counters
4. validate the operation of code conversion circuit –BCD to Excess 3 & vice versa, 4 bit parity generator & comparator circuits,
5. work effectively in a team

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE-492.CO1	3	2	1	-	-	-	-	-	3	2	-	1	3	2	1	2
PC-EE-492.CO2	3	3	3	2	-	1	-	-	3	3	-	1	3	2	1	2
PC-EE-492.CO3	3	3	3	3	-	1	-	-	3	3	-	1	3	2	1	2
PC-EE-492.CO4	3	3	3	3	-	2	-	-	3	3	-	1	3	3	1	3
PC-EE-492.CO5	3	3	3	3	-	3	-	-	3	2	-	1	3	3	1	3
Average	3	2.8	2.6	2.75	-	1.75	-	-	3	2.6	-	1	3	2.4	1	2.4

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**ELECTRICAL & ELECTRONICS MEASUREMENTLABORATORY**
Course Code:PC-EE493	**Semester: 4th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 0 hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

	Laboratory Experiments:
1.	Instrument workshop- Observe the construction of PMMC, Dynamometer, Electrothermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2.	Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3.	Calibrate dynamometer type wattmeter by potentiometer.
4.	Calibrate AC energy meter.
5.	Measurement of resistance using Kelvin double bridge.
6.	Measurement of power using Instrument transformer.
7.	Measurement of power in Polyphase circuits.
8.	Measurement of frequency by Wien Bridge.
9.	Measurement of Inductance by Anderson bridge
10.	Measurement of capacitance by De Sauty Bridge.
11.	Measurement of capacitance by Schering Bridge.

Course Outcome:

After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment and test the instrument for application to the experiment
2. construct circuits with appropriate instruments and safety precautions
3. evaluate and adjust the precision and accuracy of AC energy meter, moving iron and dynamometer type ammeter, voltmeter and wattmeter by potentiometer
4. measure voltage, current, power, energy, phase , frequency, resistance, inductance, capacitance
5. work effectively in a team

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-403.CO1	3	3	-	1	-	2	2	2	2	2	-	3	3	2	-	1
PC-EE-403.CO2	2	2	1	2	-	2	1	2	2	1	-	2	3	2	-	2
PC-EE-403.CO3	3	2	2	2	-	2	2	2	2	1	-	2	3	2	-	2
PC-EE-403.CO4	2	2	3	2	-	2	1	1	2	2	-	1	3	3	-	2
PC-EE-403.CO5	3	2	2	2	-	2	1	2	2	2	-	2	3	3	-	2
Average	2.6	2.4	2	1.8	-	2	1.4	1.8	2	1.6	-	2	3	2.4	-	1.8

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Course Code : ES-ME-491	**Category :** Engineering Science Courses
Course Title : THERMAL POWER ENGINEEING LABORATORY	**Semester** : 4th
L-T-P : **0-0-2**	**Credit: 1**

Laboratory Experiments:

1. Study of Cut Models – Boilers IC Engines: Lanchashire Boiler, Babcock & Wilcox Boiler, Cochran Boiler, Vertical Tubular Boiler, Locomotive Boiler, 4S Diesel Engine, 4S Petrol Engine, 2S Petrol Engine

2. Load Test on 4 Stroke Petrol Engine & Diesel Engine by Electrical Load Box.

3. Load Test on 4 Stroke Diesel Engine by Rope Brake Dynamometer.

4. Heat Balance on 4 Stroke Diesel Engine by Rope Brake Dynamometer & by Electrical Load Box.

5. Valve Timing Diagram on 4S Diesel Engine Model & 4S Petrol Engine Model

6. To find the Calorific Value of Diesel Fuel & Coal by Bomb Calorimeter

7. To find the Flash Point & Fire Point of Petrol & Diesel Fuel

8. To find the Cloud Point & Pour Point of Petrol & Diesel Fuel

9. To find Carbon Particle Percentage in Diesel Engine Exhaust Smoke by Smokemeter and trace the BHP Vs. % Carbon Curve

10. Measurement of the Quality of Steam – Enthalpy & Dryness fraction

After completion of this course, the learners will be able to:-

1. Identify appropriate equipment and instruments for the experiment

2. Construct experimental setup with appropriate instruments and safety precautions

3. Identify different parts of Lanchashire Boiler, Bahcock & Willcox Boiler, Cochran Boiler, Vertical Tubular Boiler, Locomotive Boiler, 4S Diesel Engine, 4S Petrol Engine, 2S Petrol engine

4. Test 4 stroke petrol engine by electrical load box and diesel engine by electrical load box and rope brake dynamometer

5. Find calorific value, flash point, fire point, cloud point, pour point of fuel. 6. work effectively in a team

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ES-ME491.CO 1	3	3	3	2	3	-	2	-	2	3	-	3	3	3	3
ES-ME491.CO 2	3	3	3	2	3	-	2	-	2	3	-	3	3	3	3
ES-ME491.CO 3	3	3	3	2	3	-	2	-	2	3	-	3	3	3	3
ES-ME491.CO 4	3	3	3	2	3	-	2	-	2	3	-	3	3	3	3
ES-ME491.CO 5	3	3	3	2	3	-	2	-	2	3	-	3	3	3	3
Average	3	3	3	2	3	-	2	-	2	3	-	3	3	3	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Ability to design and realize preliminary and basic mechanics, other basic engineering components and systems to meet desired needs within realistic constraints such as economical, environmental, social, political ethical, health and safety, manufacturability and sustainability.

PSO2: Exhibit the problem-solving ability and hands on skills to set foot on careers in the design, manufacturing, testing and installation and maintenance of mechanical systems.

PSO3: Understanding a variety of advanced applications and design of mechanical systems to make efficient utilization of alternate and renewable energy resources.

Name of the course	**ELECTRIC MACHINE-IILABORATORY**
Course Code: PC-EE 591	**Semester: 5th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 0 hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

	Laboratory Experiments:
1.	Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer &Star-Delta]
2.	Study of equivalent circuit of three phase Induction motor by no load and blocked rotor test.
3.	Study of performance of wound rotor Induction motor under load.
4.	Study of performance of three phase squirrel- cage Induction motor –determination of iron-loss, friction &windage loss.
5.	Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltagecontrol & frequency control].
6.	Speed control of 3 phase slip ring Induction motor by rotor resistance control
7.	Determination of regulation of Synchronous machine by a. Potier reactance method. b. Synchronous Impedance method.
8.	Determination of equivalent circuit parameters of a single phase Induction motor.
9.	Load test on single phase Induction motor to obtain the performance characteristics.
10.	To determine the direct axis resistance [Xd] & quadrature reactance [Xq] of a 3 phase synchronous machine byslip test.
11.	Load test on wound rotor Induction motor to obtain the performance characteristics.
12.	To make connection diagram to full pitch & fractional slot winding of 18 slot squirrel cage Induction motor for6 poles & 4 pole operation
13.	To study the performance of Induction generator
14.	Parallel operation of 3 phase Synchronous generators
15.	V-curve of Synchronous motor

Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions.

4. validate different characteristics of single phase Induction motor, three phase Induction motor, Induction generator and synchronous motor , methods of speed control of Induction motors and parallel operation of the 3 phase Synchronous generator.
5. work effectively in a team

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE-591.CO1	3	-	2	-	-	2	-	-	2	-	-	3	3	2	2	2
PC-EE-591.CO2	3	2	-	1	2	2	-	-	2	-	-	3	3	2	2	2
PC-EE-591.CO3	3	3	2	1	2	2	-	-	2	-	-	2	3	2	2	2
PC-EE-591.CO4	3	2	3	2	2	2	-	-	2	-	-	1	3	3	1	2
PC-EE-591.CO5	3	3	3	2	2	2	-	-	2	-	-	2	3	3	2	2
Average	3	2.5	2.5	1.5	2	2	-	-	2	-	-	2.2	3	2.4	1.8	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**POWER SYSTEM-I LABORATORY**
Course Code: PC-EE 592	**Semester: 5th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 0 hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

	Laboratory Experiments:
1.	Determination of the generalized constants A.B, C, D of long transmission line and regulation of a 3-Φ transmission line model
2.	Study of distribution system by network analyzer.
3.	Measurement of earth resistance by earth tester.
4.	Determination of dielectric strength of insulating oil.
5.	Determination of breakdown strength of solid insulating material
6.	Determination of parameter of 3-Φ transmission line model by power circle diagram
7.	Study of different types of insulator.
8.	Study of active and reactive power control of alternator.
9.	Study and analysis of an electrical transmission line circuit with the help of software

10.	Determination of dielectric constant, tan delta, resistivity of transformer oil.

Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions.
4. validate different characteristics of transmission line.
5. determine earth resistance, dielectric strength of insulating oil, breakdown strength of solid insulating material and dielectric constant of transformer oil.

PO-PSO / CO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
PC-EE-592.CO1	3	-	2	-	-	2	-	-	2	-	-	3	3	2	2	2
PC-EE-592.CO2	3	2	-	1	2	2	-	-	2	-	-	3	3	2	2	2
PC-EE-592.CO3	3	3	2	1	2	2	-	-	2	-	-	2	3	2	2	2
PC-EE-592.CO4	3	2	3	2	2	2	-	-	2	-	-	1	3	3	1	2
PC-EE-592.CO5	3	3	3	2	2	2	-	-	2	-	-	2	3	3	2	2
Average	3	2.5	2.5	1.5	2	2	-	-	2	-	-	2.2	3	2.4	1.8	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**CONTROL SYSTEM LABORATORY**
Course Code: PC-EE 593	**Semester: 5th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 0 hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

Laboratory Experiments:

1.Familiarization with MAT-Lab control system tool box, MAT-Lab- simulink tool box & PSPICE
2.Determination of Step response for first order & Second order system with unity feedback with the help of CRO &calculation of control system specification, Time constant, % peak overshoot, settling time etc. from the response.
3. Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB & PSPICE.
4. Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for a given system &stability by determining control system specification from the plot.
5.Determination of PI, PD and PID controller action of first order simulated process.
6. Determination of approximate transfer functions experimentally from Bode plot.
7. Evaluation of steady state error, setting time , percentage peak overshoot, gain margin, phase margin with addition of Lead, Lag, Lead-lag compensator.
8. Study of a practical position control system obtaining closed step responses for gain setting corresponding to over-damped and under-damped responses. Determination of rise time and peak time using individualized components by simulation. Determination of un-damped natural frequency and damping ratio from experimental data.
9. Analysis of performance of Lead, Lag and Lead-Lag compensation circuits for a given system using simulation.
10. Determination of Transfer Function of a given system from State Variable model and vice versa.

11. Analysis of performance of a physical system using State variable technique by simulation. Study of step response and initial condition response for a single input, two-output system in SV form by simulation.

Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions.
4. validate step response & impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB & PSPICE.
5. Determine control system specifications of first and second order systems.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE-593.CO1	3	3	3	2	-	2	2	2	2	2	-	3	3	2	-	2
PC-EE-593.CO2	3	3	3	3	-	2	1	2	2	1	-	2	3	2	-	2
PC-EE-593.CO3	3	3	3	3	-	2	2	2	1	2	-	2	3	2	-	2
PC-EE-593.CO4	3	2	3	2	-	2	1	1	2	2	-	1	3	3	-	2
PC-EE-593.CO5	3	3	3	2	-	2	1	2	2	2	-	2	3	3	-	2
Average	3	2.8	3	2.4	-	2	1.4	1.8	1.8	1.9	-	2	3	2.4	-	2

PO1: Engineering Knowledge
PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**POWER ELECTRONICS LABORATORY**
Course Code: PC-EE-594	**Semester: 5th**
Duration: 6months	**Maximum Marks: 100**
Teaching Scheme	**Examination Scheme**
Theory: 0 hr./week	**Continuous Internal Assessment:40**
Tutorial: 0hr/week	**External Assessment: 60**
Practical:2 hrs./week	
Credit Points: 1	

	Laboratory Experiments:
1	Study of the characteristics of an SCR
2	Study of the characteristics of a Triac
3	Study of different triggering circuits of an SCR
4	Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.
5	Study of the operation of a single phase full controlled bridge converter with R and R-L load.
6	Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.
7	Study of performance of step down chopper with R and R-L load.
8	Study of performance of single phase controlled converter with and without source inductance (simulation)
9	Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation)
10	Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter(simulation)
11	Study of performance of three phase controlled converter with R & R-L load. (simulation)
12	Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load.
13	Study of Zero Voltage Switching Resonant converter and Zero Current Switching Resonant Converter and to plot its output waveforms.
14	Study the speed control of universal motor to plot speed v/s α

Course outcome: After completion of this course, the learners will be able to
1. identify appropriate equipment and instruments for the experiment.
2. test the instrument for application to the experiment.
3. construct circuits with appropriate instruments and safety precautions.
4. use MAT-Lab control system tool box, MAT-Lab- simulink tool box & PSPICE for simulation of systems.
5. determine control system specifications of first and second order systems.

PO- PSO	PO 1	PO 2	PO3	PO 4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4

CO																
PC-EE-594-CO1	3	3	3	2	-	2	2	2	2	2	-	3	3	2	-	2
PC-EE-594-.CO2	3	3	3	3	2	2	1	2	2	1	-	2	3	2	-	2
PC-EE-594-CO3	3	3	3	3	-	2	2	2	1	2	-	2	3	2	2	2
PC-EE-594-CO4	3	2	3	2	-	2	1	1	2	2	-	1	3	3	1	2
PC-EE-594-CO5	3	3	3	2	-	2	1	2	2	2	-	2	3	3	2	2
Average	3	2.8	3	2.4	2	2	1.4	1.8	1.8	1.9	-	2	3	2.4	1.67	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):
PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.
PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.
PSO3: Students will be aware about the latest technology in software and hardware.
PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**POWER SYSTEM-II LABORATORY**
Course Code: PC-EE 691	**Semester: 6th**

Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 0 hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

	Laboratory Experiments:
1.	Study on the characteristics of on load time delay relay and off load time delay relay.
2.	Test to find out polarity, ratio and magnetization characteristics of CT and PT.
3.	Test to find out characteristics of (a) under voltage relay (b) earth fault relay.
4.	Study on DC load flow
5.	Study on AC load flow using Gauss-seidel method
6.	Study on AC load flow using Newton Raphson method.
7.	Study on Economic load dispatch.
8.	Study of different transformer protection schemes by simulation
9.	Study of different generator protection schemes by simulation
10.	Study of different motor protection schemes by simulation

11.	Study of different characteristics of over current relay.
12.	Study of different protection scheme for feeder.

Course outcome: After completion of this course, the learners will be able to

1. Identify appropriate equipment and instruments for the experiment.
2. Test the instrument for application to the experiment.
3. Construct circuits with appropriate instruments and safety precautions.
4. Validate the characteristics of under voltage relay, over current relay, earth fault relay, on load time delay relay, off load time delay relay, CT and PT.
5. Validate protection schemes of transformer, generator, motor and feeder.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE-691.CO1	3	2	-	-	-	-	-	-	2	-	-	3	3	2	2	2
PC-EE-691.CO2	3	2	-	-	2	-	-		2	-	-	2	3	2	2	2
PC-EE-691.CO3	3	3	-	-	2	-	-	-	2	-	-	2	3	2	2	2
PC-EE-691.CO4	3	2	-	-	2	-	-	-	2	-	-	1	3	3	2	2
PC-EE-691.CO5	3	3	-	-	2	-	-	-	2	-	-	2	3	3	2	2
Average	3	2.4	-	-	2	-	-	-	2	-	-	2	3	2.4	2	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**MICRO PROCESSOR AND MICRO CONTROLLERLABORATORY**
Course Code: PC-EE 692	**Semester: 6^{th}**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 0 hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

	Laboratory Experiments:
1.	Programs for 16 bit arithmetic operations for 8086 (using various addressing modes)
2.	Program for sorting an array for 8086
3.	Program for searching for a number or character in a string for 8086
4.	Program for String manipulations for 8086

5.	Program for digital clock design using 8086.
6.	Interfacing ADC and DAC to 8086.
7.	Parallel communication between two microprocessors using 8255.
8.	Serial communication between two microprocessor kits using 8251.
9.	Interfacing to 8086 and programming to control stepper motor.
10.	Programming using arithmetic, logical and bit manipulation instructions of 8051
11.	Program and verify Timer/Counter in 8051.
12.	Program and verify interrupt handling in 8051.
13.	UART operation in 8051.
14.	Interfacing LCD to 8051.
15.	Interfacing matrix or keyboard to 8051.
16.	Data transfer from peripheral to memory through DMA controller 8237/8257

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE-692.CO1	3	1	-	-	-	-	-	-	3	3	-	-	3	1	-	-
PC-EE-692.CO2	3	3	3	2	-	-	-	-	3	3	-	-	3	3	2	3
PC-EE-692.CO3	3	3	3	3	2	1	-	-	3	3	-	1	3	3	2	3
PC-EE-692.CO4	3	3	3	3	2	2	-	-	3	3	-	2	3	3	2	3
PC-EE-692.CO5	3	3	3	3	2	2	-	-	3	2	-	3	3	3	2	3
Average	3	2.6	3	2.75	2	1.67	-	-	3	2.8	-	2	3	2.6	2	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Name of the course	**ELECTRICAL AND ELECTRONICS DESIGN LABORATORY**
Course Code: PC-EE 681	**Semester: 6th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 1hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 4 hrs/week	
Credit Points:3	

	GROUP A
1.	**Designing a heating element with specified wattage, voltage and ambient temperature.**
2.	**Designing an aircore grounding reactor with specified operating voltage, nominal current and fault current**
3.	**Designing the power distribution system for a small township**
4.	**Designing a double circuit transmission line for a given voltage level and power (MVA) transfer.**
5.	**Wiring and installation design of a multistoried residential building (G+4,not less than 16 dwelling flats with a lift and common pump)**
	GROUP B
6.	**Designing an ONAN distribution transformer.**
7.	**Designing a three phase squirrel cage induction motor.**
8.	**Designing a three phase wound rotor induction motor.**
9.	**Designing a split phase squirrel cage induction motor for a ceiling fan or a domestic pump.**
10.	**Designing a permanent magnet fractional hp servo motor .**
	GROUP C

	11. Design the control circuit of a Lift mechanism
	12. Design a controller for speed control of DC machine.
	13. Design a controller for speed control of AC machine.
	14. Electronic system design employing electronic hardware (Analog, Digital, Mixed signal), microcontrollers, CPLDs, and FPGAs, PCB design and layout leading to implementation of an application

Topics to be covered in the Lecture class:

1.	**Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits; Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system design, Interfacing of analog and digital systems, Embedded systems,; System assembly considerations..**	

Course outcome: After completion of this course, the learners will be able to

1. Explain basic concept of measurement, noise in electronic system, sensor and signal conditioning circuits
2. Implement pc based data acquisition systems and construct circuits with appropriate instruments and safety precautions
3. Design heating elements, air core grounding reactor, power distribution system for small township, double circuit transmission line and electric machines
4. Do wiring and installation design of a multi-storeyed residential building with lift and pump
5. Design electronic hardware for controller of lift, speed of ac/dc motor, and for an application with analog, digital, mixed signal, microcontroller and pcb

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE 681.CO1	3	3	3	3	2	2	-	-	1	-	-	3	3	3	1	3
PC-EE 681.CO2	3	3	3	3	2	2	-	-	1	-	-	3	3	3	1	3
PC-EE 681.CO3	3	3	3	3	2	2	-	-	1	-	-	3	3	3	1	3
PC-EE 681.CO4	3	3	3	3	2	2	-	-	1	-	-	3	3	3	1	3
PC-EE 681.CO5	3	3	3	3	2	2	-	-	1	-	-	3	3	3	1	3
Average	3	3	3	3	2	2	-	-	1	-	-	3	3	3	1	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

Name of the course	**ELECTRIC DRIVE LABORATORY**
Course Code: PC-EE 791	**Semester: 7th**
Duration: 6 months	**Maximum marks:100**
Teaching Scheme	**Examination scheme:**
Theory: 0 hr/week	**Continuous Internal Assessment:40**
Tutorial: 0 hr/week	**External Assessment: 60**
Practical: 2 hrs/week	
Credit Points:1	

Laboratory Experiments:

1. Study of speed control of Thysistor controlled DC Drive.
2. Study of speed control of Chopper fed DC Drive
3. Study of speed control of single phase motor using TRIAC.
4. Study of PWM Inverter fed 3 phase Induction Motor control using software.
5. Study of VSI / CSI fed Induction motor Drive using software.
6. Study of V/f control of 3phase Induction motor drive.
7. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.
8. Study of Regenerative / Dynamic braking operation for DC Motor - Study using software.
9. Study of Regenerative / Dynamic braking operation of AC motor - study using software.
10. Study of PC/PLC based AC/DC motor control operation.

Course outcome: After completion of this course, the learners will be able to

1. identify appropriate equipment and instruments for the experiment.

2. test the instrument for application to the experiment.

3. construct circuits with appropriate instruments and safety precautions.

4. apply different methods of control of Electric Drive in the laboratory.

5. analyse experimental data obtained in the laboratory and work effectively in a team.

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
PC-EE-791.CO1	3	3	3	2	1	2	1	-	-	-	-	3	3	2	-	2
PC-EE-791.CO2	3	3	3	3	1	2	1	-	-	-	-	2	3	2	-	2
PC-EE-791.CO3	3	3	3	3	1	2	1	-	-	-	-	2	3	2	2	2
PC-EE 791CO4	3	2	3	2	1	2	1	-	-	-	-	1	3	3	1	2
PC-EE-791CO5	3	3	3	2	1	2	1	-	3	-	-	2	3	3	2	2
Average	3	3	3	2.4	1	2	1	-	3	-	-	2	3	2.4	1.67	2

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

Subject Code: **PW-EE 781**	Category: **Project**	
Subject Name: **Project stage-I**	Semester: **VII**	
L-T-P:**0-0-4**	Credit: **2**	
Course Objectives: This course is aimed to provide more weightage for project work. The project work could be done to fabricate and demonstrate an innovative machine or product that could be encouraged under this course.		

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Gather some exposure on some projects,

CO2: Understand the procedure to carry out practical projects.

CO3: Designing some innovative ideas

CO4: Fabricating and/or demonstrating an innovative machine or product.

CO-PO & CO-PSO Mapping

	PO 1	*PO 2*	*PO 3*	*PO 4*	*PO 5*	*PO 6*	*PO 7*	*PO 8*	*PO 9*	*PO10*	*PO11*	*PO12*	*PSO 1*	*PSO 2*	*PSO3*	*PSO 4*
PW-EE 781*CO1*	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
PW-EE 781*CO2*	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
PW-EE 781*CO3*	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
PW-EE 781*CO4*	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
Avg	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field.

Subject Code: **PW-EE 881**	Category: **Project**	
Subject Name: **Project stage-II**	Semester: **VIII**	
L-T-P:**0-0-16**	Credit: **8**	
Course Objectives: This course is aimed to provide more weightage for project work. The project work could be done to fabricate and demonstrate an innovative machine or product that could be encouraged under this course.		

Course Outcomes:

Upon completion of this course, students will be able to:

CO1: Formulate a practical or design problem and explore its possible solution after suitable review of literature.

CO2: Analysis the given problem and find the safest suitable solution on the basis of engineering knowledge.

CO3: Evaluate the outcome of the problem and validate findings on the basis of experimentation/analysis.

CO4: Produce the content in the form of report as per the standard scientific norms.

CO-PO & CO-PSO Mapping																
	PO 1	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*	*PSO1*	*PSO2*	*PS O3*	*PS O4*
PW-EE 881*CO 1*	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
PW-EE 881*CO 2*	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
PW-EE 881*CO 3*	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3

PW-EE 881*CO 4*	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
Avg	3	3	3	2	3	3	2	2	2	2	2	2	3	3	3	3
1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: If there is no correlation																

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Program Specific Outcomes (PSOs):

PSO1: Students will have adequate knowledge of Electrical Engineering to become employable in industry.

PSO2: Students will have strong fundamentals and problem solving skills to analyze, design and develop economically feasible solutions for technical problems.

PSO3: Students will be aware about the latest technology in software and hardware.

PSO4: Students will be able to function effectively in multi-disciplinary field

OmDayal Group of Institutions
Department of Architecture

Subject Code: **ARCH 103**	Category: **Professional Course**
Subject Name: **Engineering Mechanics**	Semester: **I**
L-S-P: **3 – 0 - 0**	Credit: **3**

PREREQUISITE: Physics, Mathematics

COURSE OBJECTIVE

To understand the basic principles of structural mechanics that would be pertinent to simple design elements and also to understand the structural behaviour of building elements.

Module No.	DESCRIPTIONS OF TOPIC	CONTACT HOURS
Module-1	**Introduction:** Concept of Engineering Mechanics – Statics & Dynamics – Scalar Quality – Vector Quality – Addition & Subtraction of Vectors – Basic units – Derived Units – SI units – Relationship: M.L.T. **System of Forces:** Definition of a force with explanation – Linear representation of force – System of co-planar forces – Parallelogram Law of Forces – Composition and Resolution – Transmissibility of forces – Action and Reaction – Triangle Law & Polygon Law of forces – Determination of Resultant by Analytical and graphical method with equalitarian space diagram – Vector diagram – Bow's notation. **Moments & Couples:** Definition of moment of a force about a point – Physical significance of moment – Moment of a system of parallel and inclined forces – Varignon's Theorem – Definition of moment of a couple – Physical significance of Couples Equivalent couples – Resultant of any number of coplanar couples – Replacement of a force about a point by an equal like parallel force together with a couple – Resultant of a couple and a force. **Condition of Equilibrium:** Lami's Theorem – Triangle Law & Polygon Law of equilibrium – Conditions of equilibrium of co-planer system of concurrent forces – Conditions of equilibrium of co-planar system of non-concurrent parallel forces (like & unlike) – Conditions of equilibrium of co-planar system of non-concurrent non-parallel forces (simple problems excluding statically in determinant).	16 H
Module-2	**Friction:** Definition – Useful and harmful effects of friction – Laws of Static friction – Co-efficient of friction – Angle of friction – Angle of repose – Equilibrium of a body on a rough inclined surface with and without external force. **Centre of Gravity:** Concept & definition – Centre of mass – Centroid, Methods of finding out centroids of simple area,	12 H

	Finding the centroid of the following areas by integration**:** (i) uniform triangular lamina, (ii) uniform rectangular lamina, (iii) uniform circular lamina, (iv) uniform semi-circular lamina, and, (v) uniform lamina of quadrant of a circle, Finding the centriod of the following sections using the method of moment**:** (i) T-section, (ii) equal and unequal angle- sections, (iii) equal and unequal I-sections, (iv) Channel-sections, (v) Z-sections. **Moment of Inertia:** Introduction – definition and unit, M I of a lamina, Theorems of finding out M I by**:** (i) Parallel axis theorem, and, (ii) Perpendicular axis theorem, Radius of Gyration, Finding out M I of the different sections about axes lying in the plane of the sections by integration**,** M I of irregular areas such as I-sections, T-sections, Angle-sections, Channel sections, Z-section, Composite sections (composite area method) – Related simple problems, Polar M I.	
Module-3	**Rectilinear Motion:** Displacement - Time and Velocity-Time diagrams – Motion equations (with deduction) – Newton's Second Law of linear motion p = mf and momentum of a body – Conservation of momentum of a body – Numerical problems. **Curvilinear Motion:** Angular displacement – Angular speed – Angular velocity – Relation between angular speed & angular velocity – Angular acceleration – Relation between linear & angular velocity – Relation between linear & angular acceleration – Motion and path of a projectile (numerical problems) – Centripetal and centrifugal force (numerical problems).	12 H

Course Outcomes (COs):

On successful completion of this course, student should be able to:

CO1. Determine nature of forces and its final effects

CO2. Understand basic principles of structural mechanics in equilibrium condition

CO3. Analyze minor structural elements under different external forces and friction

CO4. Understand and determine Centroid of simple area and Moment of Inertia of different sections

CO5. Understand and analyze bodies under Rectilinear and Curvilinear motion

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
ARCH103. 1	3	3	1	-	-	-	-	-	1	-	-	-
ARCH103. 2	3	2	-	-	-	-	-	-	1	-	-	-
ARCH103. 3	3	3	1	-	-	-	-	-	1	-	-	-
ARCH103.4	3	3	1	-	-	-	-	-	1	-	-	1
ARCH103.5	3	3	1	-	-	-	-	-	1	-	-	1
Average	3	2.8	1	-	-	-	-	-	1	-	-	1

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH 104	Category: Architecture
Subject Name: History of Art and Architecture	Semester: **I**
L-T-P: 3-0-0	Credit:**3**

Course Objectives:
To develop an understanding of the physical experience of buildings in order to appreciate the complexity of the influences bearing on architecture, as reflected in the major historical periods beginning.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Art through ages:** Architecture as art, milestones in art from the Prehistoric, Palaeolithic, Neolithic, Classical, Medieval, Renaissance and Modern periods. Indian art heritage, Art consciousness; Aesthetics, perception, Symbolism, expression, style, fashion, appropriateness and values.	10
2	**Ancient Mesopotamia:** Detail study of art and architecture in (a) the City of Ur, Mesopotamia (Iraq) as constructed by the Sumerians, and, (b) the City of Babylon, Mesopotamia (Iraq) as reconstructed by Nebuchadnezzar II.	9
3	**Egypt and Central America:** Tomb architecture of monumental scale: Mastabas, Royal Pyramids and Rock- hewn Tombs — Detail study of the Great Pyramid of Cheops, Gizeh — Temples: Great Temple of Amun, Karnak, Thebes — Idea about Pylons, Obelisks and Sphinx. Detail study of the Temple I (the Temple of the Giant Jaguar), Tikal (Guatemala) of the Maya Late Classic Period.	9
4	**Indus Valley Civilization:** Relatively egalitarian society – prominent features of town planning – burnt-brick laid in mud-mortar in 'English bond' – no instance of true arch: openings spanned by wooden lintels —Study of the city of Mohen-Jo-Daro, Indus valley (Pakistan) with reference to its great bath and great granary.	6
5	**Elements of Architecture:** Investigations in proportion, scale, balance, rhythm, symmetry, hierarchy, pattern and axis with examples from the built environment. Influence on Architectural design; development of aesthetic sensitivity as a prerequisite for all designers	6

Course Outcomes:
1. The students shall gain knowledge about the chronological development of Art & Architecture through ages and understanding relation and impacts between art and architecture.
2. Understanding the socioeconomic cultural and political influence behind the evolution of Mesopotamian settlements through the Fertile Crescent.
3. Gaining knowledge about the constructional details and their impacts on the society of Egyptian and meso-american monuments.
4. Understanding the developments in concepts of city planning, building science and materials in Indus valley Civilization.
5. Learning different basic elements of architecture and their implementation.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BSM101.CO1	2	3	3	3	1	2	1	_	2	3	_	3
BSM101.CO2	3	3	3	3	1	2	3	_	2	3	_	3
BSM101.CO3	3	2	3	3	1	2	3	_	2	3	_	3
BSM101.CO4	3	3	3	3	1	2	3	_	2	3	_	3
BSM101.CO5	3	2	1	3	2	2	1	_	2	3	_	3
Average	2.8	2.8	2.6	3	1.2	2	2.2	_	2	3	_	3

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Department of Architecture

Subject Code: **ARCH 202**	Category: **Professional Course**
Subject Name: **STRENGTH OF MATERIALS**	Semester: **II**
L-S-P: **3 – 0 - 0**	Credit: **3**

PREREQUISITE: Physics, Mathematics and Engineering Mechanics

COURSE OBJECTIVE

To understand the basic principles of strength of structural materials that would be pertinent to simple design elements

Module No.	DESCRIPTIONS OF TOPIC	CONTACT HOURS
Module-1	**SIMPLE STRESSES & STRAINS:** Mechanical Properties of Materials Definitions with explanations only. Different types of loads and their effects on materials – Tensile, Compressive, Shear and Impact Simple stresses and types of stresses, Simple strains and type of strains Stress-strain diagram for M.S. in tensile test showing salient points such as Proportional Limit, Yield point, Elastic Limit, Ultimate points and Breaking Point. Study of stresses – Strain diagram for Cast Iron and Dead Steel. Modulus of Elasticity. Ultimate stress, working stress and factor of safety and their effect on simple designs. Stresses in members with stepped cross section and stress in composite members. Stress in nuts and bolts. Temperature, stress and strain. Simple problems.	12 H
Module-2	**SHEAR FORCE & BENDING MOMENT:** Types of beams, types of supports and types of loads on beams Definitions of Bending Moment and Shear Force and their sign conventions. Bending Moment and Shear Force diagrams of simple cases such as**:** (i) Cantilever beams with point loads and UDL. (ii) Simply supported beams with point loads and UDL. (iii) Simply supported overhanging beam – one side and both sides. (iv) Simple Problems.	9 H
Module-3	**BENDING STRESSES IN BEAMS**: Introduction to bending and shear, pure bending, assumption and theory of simple bending, neutral axis, moment of resistance, section modulus and radius of gyration, Shear stress in Beam, Shear stress distribution in rectangular and circular section, related problems.	9 H
Module-4	**DEFLECTION OF BEAMS:** Problems related to above two cases of cantilever and simply supported beams. Fundamental concepts: elastic curve, moment –curvature	6 H

	relationship, governing differential equation, boundary conditions. Relation among deflection, slope, shear force, bending moment and rate of loading, sign convention of slope and deflection. Deflection of beam by Direct Integration and Macaulay's Method-Problem related to cantilever, simply supported and overhanging beams.	

Course Outcomes (COs):

On successful completion of this course, student should be able to:

CO1. Understand the concept of stresses and strains in a member and their types

CO2. Evaluate the salient points regarding stress-strain diagram for M.S. under tensile force

CO3. Analyze Bending Moment and Shear Force and SFD & BMD of beams under specific loading condition

CO4. Determine the bending stresses and shear stresses in a beam subjected to system of loads

CO5. Evaluate the slope and deflection of beams subjected to loads

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
ARCH202. 1	3	-	-	-	-	-	-	-	-	-	-	-
ARCH202. 2	3	3	-	2	-	-	-	-	1	-	-	
ARCH202. 3	3	3	-	-	-	-	-	-	1	-	-	1
ARCH202.4	3	3	-	2	-	-	-	-	1	-	-	1
ARCH202.5	3	3	-	-	-	-	-	-	1	-	-	1
Average	3	3	-	2	-	-	-	-	1	-	-	1

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH - 203	Category: Architecture Course
Subject Name: History of Architecture - I: Buddhist and Hindu	Semester: **II**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:
To provide an understanding of the evolution of Buddhist and Hindu architecture of the Indian sub-continent, characterized by technology, ornamentation, and planning practices.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Buddhist Art and Architecture:** Supreme sacred monument of Buddhism – Basic form: solid domical mound crowned by chhatra (umbrella) – More monumental Stupas: surrounded by Vedika (railing) with Toranas (gateways) at cardinal points — Detailed study of the Great Stupa (Stupa 1), Sanchi **Rock-cut Architecture and Cave paintings:** Pillars Plain unornamented circular shaft – Campaniform capital – circular abacus with animal motif – Study of the Lion Capital, Sarnath, Uttar Pradesh, Early Rock-cut Architecture: Simple woodwork imitating forms – Study of the Lomash Rishi Caves, Barabar Hills, Bihar, Orissan Group (Jain): Monastic retreat only without any Chaitya or Stupa – semi-circular arches with simple brackets – Study of the Rani Gumpha, Udayagiri, Orissa.	6
2	**Hinayana Phase:** Necessity of monasteries suitable for congregational worship, forbiddance of worship of Buddha's image **-** leading to –Chaityagriha & Vihara hewn out of rock, introduction of symbolic forms – translation of carpentry forms into stones, horseshoe-arch-gable – Study of the Chaitya Hall, Karli, Maharashtra. **Mahayana Phase**: Influence of Hinduism – introduction of image – change in disposition of inner most cells of Vihara serving as monastery as well as sanctuary – Study of the Ajanta Cave No. 19, Maharashtra. **Final Phase (Brahminical):** Gradual elaboration of interior from primitive singular cell to isolated cell with ambulatory – culmination in emulation of structural temple – Study of the Kailasa Temples, Ellora, Maharashtra.	6
3	**Earliest Temple:** Roof suggesting timber & thatch origin – later addition of tower & pillared porch – square shaft with 'cushion' capital – lack of proportion – study of the LAD KHAN TEMPLE, AIHOLE — evolution of structured temple: *vimana* (shrine) with *sikhara* (tower), *garbhagriha* (sanctum), *mandapa* (assembly hall), *antarala* (vestibule), *pradakshinapatha* (ambulatory) – two main styles: dravidian&indo-aryan	9
4	**Temple Architecture of Southern India: Dravidian Style:** Pallava: Origin from rock-cut architecture – mandapa or pillared hall with a cell – Study of the monolithic Rathas, Mammallapuram Chola: Simplicity in treatment – lofty vimana – pillared mandapa aligned axially within walled enclosure – 'kalasa' capital replacing Pallava Lion capital Pandya: Concentric walls enclosing prakarana (open courtyards) – introduction of gopuram (temple portal)	9

	Vijaynagar: Elaboration in ceremony – addition of Amman shrine & 'Kalyan' mandapa Madura: Two main temple formations: (a) inner flat-roofed courtyard with vimana thrusting above, and, (b) outer open courtyard – rectangular plan enclosed within high boundary wall with series of gopuram – interior pillars with foliated or gryphon brackets – Study of the Meenakshi Temple, Madura.	
5	**Temple Architecture of Northern India: Indo-Aryan Style:** Orissa Group**:** Separate nomenclature (*RekhaDeul, PidaDeul, Jagamohan, Rahapaga, Pista etc.*) – Wall enclosing axially aligned structures without pillars – interiors devoid of ornamentations – exteriors decorated with figure sculptures – Study of the Lingaraja Temple, Bhubaneswara Khajuraho Group**:** Elegantly proportioned detached temples without enclosing wall in 'Latin cross' plans – separate domical roofs gradually increasing in height grouped centripetally – rich surface ornamentation – Study of the Kandarya Mahadeva Temple. WESTERN INDIAN GROUP: Exuberantly curved white marbles on vaulted ceilings surrounded by high enclosing walls of cells, enshrining statues of 'Jina' – open portico & vestibule leading to enclosed shrine with octagonal nave – obscured structural consideration – Study of the Dilwara Temple, Mount Abu.	9

Course Outcomes:

1. Students will understand the diversity of architecture in India specially **Buddhist Art and Architecture** and **Rock-cut Architecture and Cave paintings**.
2. Students will understand the diversity of architecture in **Hinayana Phase, Mahayana Phase and Final Phase (Brahmanical)**.
3. Students will understand the construction and detail of **Earliest Temples in India**
4. Students will gain the knowledge about **Temple Architecture of Southern India: Dravidian Style**.
5. Students will gain knowledge about the design variables of **Temple Architecture of Northern India: Indo-Aryan Style** construction techniques, materials and craftsmanship used in the historical buildings of Indian Subcontinent

CO-PO	History of Architecture: Buddhist and Hindu											
	ARCH - 203 : Programme Outcomes											
	Engineering Knowledge	Problem Analysis	Design/ Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Engineer and Society	Environment and Sustainability	Ethics	Individual and Team Work	Communic ation	Project Managem ent and Finance	Life-long Learning
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C203-1	2	1	1	1	-	3	2	-	1	1	-	2
C203-2	2	1	1	1	-	3	2	-	1	1	-	2
C203-3	2	1	1	1	-	3	1	-	1	1	-	3
C203-4	2	1	2	2	-	3	2	-	2	1	-	3
C203-5	3	1	2	2	-	3	3	-	2	1	-	3
Average	2.2	1	1.4	1.4	-	3	2.0	-	1.4	1	-	2.6

Mapping Corelation	Low	Medium	High	No
	1	2	3	-

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH 204	Category: Architecture
Subject Name: MATERIALS AND CONSTRUCTION-I	Semester: **II**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:
To introduce students to various building materials and masonry construction practices

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Conventional construction materials** like mud, bricks, stone and timber- raw material manufacturing processes, composition, classifications, properties, uses and finishes.	12
2	**Ferrous Metals(Iron& Steel) and Non ferrous Metals (Aluminium& Copper)** - Characteristics, Properties, Uses.	3
3	**Plastics and Glass –** Characteristics, Properties, Uses, Types.	3
4	**Cement and Mortar-** Characteristics, Properties, Uses, Types.	9
5	**Conventional and Non – Conventional (Precast, Prestressed, FRC, Ferro cement) Concrete**-Definition, Characteristics, Constituent Materials, Properties, Types.	9

Course Outcomes:
1. Students will learn the uses, properties and applications of various conventional constructional materials like mud, bricks, stone and timber.
2. Students will learn Characteristics, Properties, Uses of Ferrous Metals(Iron& Steel) and Non ferrous Metals (Aluminium& Copper).
3.Students shall gain knowledge about Characteristics, Properties, Uses, Types of Plastics and Glass as building material.
4. Obtaining the knowledge regarding the Characteristics, Properties, Uses, Types of Cement and Mortar.
5. Students will learn the Definition, Characteristics, Constituent Materials, Properties, Types of Conventional and Non – Conventional (Precast, Prestressed, FRC, Ferro cement) Concrete.

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH204-1	3	3	2	2	1	2	2	_	1	2	_	3
ARCH204-2	3	3	2	2	1	2	2	_	1	2	_	3
ARCH204-3	3	3	3	2	1	2	2	_	1	2	_	3

ARCH204-4	3	3	3	2	1	3	2	_	1	2	_	3
ARCH204-5	3	3	3	3	1	3	2	_	1	2	_	3
Average	3	3	2.6	2.2	1	2.4	2	_	1	2	_	3

OmDayal Group of Institutions

Department of Architecture

Subject Code: **ARCH 302**	Category: **Architecture**
Subject Name: **Climatology**	Semester: **III**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

To understand climate and its impact on architectural design and to understand the fundamentals of climatology and environmental studies.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Climate & weather**: Basic climatic zones: hot & arid, hot / warm & humid, cold. Climatic factors: solar radiation & temperature, clouds, relative humidity, prevailing wind; measuring instruments and SI units	**9**
2	**Comfort Conditions** : Requirement of ventilation; Heat balance of body Sun path diagram — comfort zone & bio-climatic chart — comfort range Air change per hour — recommended values of air changes for different occupancies as per the NBC Methods of ventilation Climatic factors affecting building design and orientation	**9**
3	**Natural Ventilation** : Principle of nature ventilation in buildings Cross-ventilation — position of openings – size of openings — control of openings: sashes, canopies, louvers wind shadow — humidity control: wind scoop	**6**
4	**Means Of Thermal Control** : Structural Controls Solar control: internal blinds & curtains – heat absorbing glasses Sun’s position: effects of angle of incidence – stereographic projection – shadow angles Shading devices: vertical &horizontal – design of shading devices	**6**
5	**Daylighting:** Sources of light of a point inside a building: skylight externally reflected light, internally reflected light, direct sunlight — working plane. Daylight factor — components of daylight factor: SC, ERC, and IRC—daylight penetration.	**6**

Course Outcomes (CO):

1. Introduction of different **climatic zones** and the **climatic factors**.
2. Introduction of **psychometric chart, bioclimatic chart, solar geometry** and its application with respect to buildings and human comfort.
3. Learn the principles of **thermal comfort** and its implication in design.
4. To understand the **design strategies** for **different climatic regions**.
5. Learn and apply the concept that will help to design **climate responsive buildings** considering the impact of **climatic factors**, **comfort conditions, natural ventilation** and **day lighting**.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH302.CO1	2	3	1	3	_	1	2	_	_	_	_	3
ARCH302.CO2	2	3	2	3	2	1	3	_	_	_	_	3
ARCH302.CO3	2	2	2	3	_	1	2	_	_	_	_	3
ARCH302.CO4	2	3	3	3	2	1	3	_	_	_	_	3
ARCH302.CO5	2	3	3	3	1	1	3	_	_	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

College of Architecture

Subject Code: ARCH 303	*Category: Architecture*
Subject Name: History of Architecture-II (Islamic)	*Semester: 3*
L-T-P: ***3-0-0***	*Credit:* ***3***

Course Objectives*:*

To provide an understanding of the evolution of Islamic Architecture in India in their various stylistic modes characterised by technology, ornamentation and planning practices.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	**Beginning of Islamic Architecture in India** Dominated by Persian style – Vocabulary of typical Islamic architecture: Arcuated architecture – Mortar-masonry – Pointed arches – Domes – Stalactite corbels – Arabesque – Stone grill & pierced screen –The Slave Dynasty: Study of parts of a typical mosque with reference to the Quwwat-ul-Islam Mosque, Old Delhi – Study of the Qutb Minar, Old Delhi.	*6*
2	**The Sayyid & Lodhi Dynasties** The Sayyid & Lodhi Dynasties and The Buildings of Sher Shah Sur Sayyid & Lodi Dynasties: Two forms of tombs – (a) single storied octagonal tomb surrounded by arched veranda, and, (b) two / three storied square tomb without veranda; both mounted by domes, range of pillared kiosk over parapet Study of the Tomb of Sher Shah : Grand 17olute17ment of the Lodi style – harmonious transition from square form of lower storeys to diminishing octagonal forms surmounted by circular base of crowning hemispherical dome with finial	*6*
3	**The Early Mughal architecture -** <u>Akbar:</u> Style executed in red sandstone with insertion of marble – trabeated construction system with frequent use of four-centred arch giving visual impression of arcuated style – hollow dome – many sided pillars with bracket capital – carving or bold inlay ornamentation with occasional painted design Study of Planning features of the Fatehpur Sikri : The politics of Architecture – Visual Unity through sandstone – Symmetry around multiple axes – Study of (a) the Diwan-i-Khas, and, (b) the Buland Darwaja. **Provincial Style of Bengal –** Brief reference to the first two phases: Brick structures necessitating arcuated style – short pillars supporting pointed ‘drop’ arches & vaults in brick — Typical features of Third phase: Curvilinear form of roof originating from thatched bamboo hut facilitating water drainage – Study of (a) the Eklakhi Tomb, Pandua, and, (b) the Qadam Rasul Masjid, Gaur.	*12*
4	**Later Phase** Jahangir : Keener interest towards nature than in buildings – Formal Mughal Gardens in Kashmir – Study of the Shalimar Garden, Kashmir Shahjahan : Age of marble – fine & restrained moulding – inlaid pattern of decoration in coloured stone – dome assuming Persian bulbous form constricted at neck – system of true double doming – 17 voluted bracket capital & foliated base of pillions – Study of the (a) Red Fort emphasising planning & design of the Diwan-i-am; and, (b) the Taj Mahal emphasising on both tomb and garden.	

Course Outcomes:

1. Understand the role of geography, society and existing knowledge on architectural solutions (with respect to Islamic Architecture in Indian Subcontinent)
2. Learn about different building types and their design challenges and solutions with respect to specific purposes of the time and place (with respect to Islamic Architecture in Indian Subcontinent)
3. Learn to draw and read drawings of different buildings and buildings elements (with respect to Islamic Architecture in Indian Subcontinent)
4. Learn to express graphically, in writing, orally, in live presentation - concepts learned and internalised and how to relate them to other contexts (with respect to Islamic Architecture in Indian Subcontinent)
5. Application of knowledge from history in present cases and the student's personal design projects (with respect to Islamic Architecture in Indian Subcontinent)

PO → *CO ↓*	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
ARCH303-CO1	3	-	-	-	2	3	3	-	3	-	-	3
ARCH303-CO2	3	-	-	-	2	3	3	-	3	-	-	3
ARCH303-CO3	3	-	-	-	2	3	-	-	3	-	-	3
ARCH303-CO4	3	-	-	-	2	3	-	-	3	3	-	3
ARCH303-CO5	3	-	-	-	3	3	3	3	3	-	-	3
Average	3	-	-	-	2.2	3	3	3	3	3	-	3

PO1: Engineering Knowledge
PO2: Problem Analysis
PO3: Design/Development of Solutions
PO4: Conduct Investigations of Complex Problem
PO5: Modern Tool Usage
PO6: The Engineer and Society
PO7: Environment and Sustainability PO8: Ethics
PO9: Individual and Team Work
PO10: Communication
PO11: Project Management and Finance
PO12: Life-long Learning

Department of Architecture

Subject Code: ARCH 304	Category: Departmental Course
Subject Name: Materials and Construction II	Semester: **III**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

To acquaint the students with constructional systems of various types of foundations, both shallow and deep, types of damp proofing techniques, various types of Corbels, Lintels and Arches and construction techniques and materials of Floor slabs other than Ground floor.

Course Content:

Module No		Contact Hrs.
1	**Foundations** - Purpose; Essential requirements; Settlement; Classification – Shallow (Wall footings, Inverted arch foundation, Isolated footings, Combined footing, Strip footing, Cantilever footing, Mat or raft foundation) Deep: (Pile foundation, Pier foundation)	9
2	**Damp Prevention and Water Proofing -** Causes and effects of dampness in buildings; Methods of damp prevention - Membrane damp proofing, Integral damp proofing, Surface treatment, Guniting; Damp Proofing of Basement, Foundation & Plinth, Cavity walls, Projections, Expansion/Seismic Joints; Water proofing treatment - Flat Roofs & Terraces, Parapet Wall (Details of Coping and Drip course), Window-Sill & Chajja (Detail of Drip course)	6
3	**Spanning of Openings: -** Corbels, Lintels and Arches; Typical detail of a masonry window opening showing sill, lintel & chajja projection. Lintel types by construction methods: Brick lintel, RCC lintel (precast and cast-in-situ); Typical details of an arch opening with nomenclature; Types of Arches - Semi-circular, Segmental, Flat, Relieving arch etc	6
4	**Upper Floors: -** Timber Floor; Jack arch floor; RCC Floor - Slab (one-way, two-way & cantilever), Beam & slab, Flat Slab, Ribbed floor. Pre-cast concrete floors; Steel Floor with joist and deck-plate.	9

COURSE OUTCOMES (CO): COURSE OUTCOME (CO)	DESCRIPTION
CO1	Knowledge about various types of Foundations, both shallow and deep, special types of foundations and requirement of using such types of foundations under conditions of constraint arising in construction sites. Learning about Different types of heavy foundations used in case of building or structure imposing extremely high loads on the soil strata.
CO2	Knowledge about various types of differences between shallow and deep foundations. Especially between the requirement and usage conditions of isolated, strip and strap footings on one hand, and pile footings and caissons or well foundations, on the other hand.
CO3	Knowledge and usability of various types of damp prevention and water proofing techniques used in construction sites. Also learning about various methods of Damp prevention and water proofing techniques and their usage conditions.
CO4	Knowledge about various types of Corbels, Lintels and Arches and their Construction Techniques. Learning about architectural details of Window Sill and Chajja Projections. Learning about various types of Arches as per their geometric shapes and Nomenclature of Arches.
CO5	Knowledge about different types of materials used for constructing Floor slabs other than ground floors. Usage of various types of construction techniques and learning how to make architectural details of such type of floor slabs and their connection with walls or columns with support of various types of beams.

Course Outcomes:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 504.CO1	3	3	3	3	3	3	2	-	-	-	2	3
ARCH 504.CO2	3	3	3	3	2	3	2	_	_	_	2	3
ARCH 504.CO3	3	3	3	3	2	3	3	_	-	_	2	3
ARCH 504.CO4	3	3	3	2	_	3	1	_	_	-	2	3
ARCH 504.CO5	3	3	3	3	1	3	2	-	_	_	2	3
Average	3	3	3	2.8	2	3	2	-	-	-	2	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Architecture

Subject Code: ARCH 402	Category: Core Architecture Theory
Subject Name: Acoustics	Semester: **IV**
L-T-P: **2-1-0**	Credit:**3**

Course Objectives:

To understand the behavior of sound in an enclosed space and remedial measures for controlling unwanted noise, towards creating the most favorable conditions for indoor and outdoor acoustic environment.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Nature of Sound:** Sound Waves, Sound Levels- Power, Intensity and Pressure, Auditory Range - thresholds of hearing & pain, Decibel scale, Sound Effects on Human; Incidence of Sound-reflection, absorption & transmission; Noise, Sound in Open Air- effects of wind flow & temperature gradients, acoustic shadow; Sound in Enclosed Space-air-borne & structure-borne (impact) sound, direct & reverberant components, reverberation time using Sabine's formula (dead & live room), echo, resonance.	9
2	**Environmental Acoustics:** Various Noise Sources, Planning Against Noise-zoning, distancing & screening, green belts & landscaping, noise barriers, Outdoor Noise Regulations in India, Open-air Auditorium.	6
3	**General Building Acoustics:** Acceptable Indoor Noise Levels, Transmission Loss and insulation against air-borne sound, Various Sound Absorbents, Reduction of Noise, Noise isolators in Construction- hollow & composite wall, resilient surface materials, floating floor construction for concrete & wooden floors, suspended ceiling, Acoustic treatment of skirting, windows & ventilators.	9
4	**Residential Buildings & Educational Buildings:** Sources of Noise and Recommendations- site planning, internal planning sound insulation.	6
5	**Auditoria and Theatres:** Sources of Noise- outdoor and indoor, Recommendations- geometry & shape, seating arrangement, design criteria for different purposes; Electro-acoustic installation.	6

Course Outcomes:

CO 1: Understand the nature of sound and how it affects various architectural spaces. Understand standard measurement methods that are used in building acoustics and analyze acoustic properties of typically used materials for design consideration. Apply prediction methods to assess the transmission of sound and reverberation of sound.

CO 2: Understand noise and various sources of noise. Apply prediction methods to assess the transmission of noise in buildings and its surroundings, its mitigation through multiple means.

CO 3: Select appropriate building constructions methods and design techniques for the solution of practical noise problems and evaluate their performance

CO 4: Learn various ideologies and context of designs thereby developing their own theories and applying the same knowledge in their own design skills.

CO 5: Make basic room acoustic measurements and determine the various indicators used for auditorium acoustics

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 402.CO1	3	2	1	-	3	-	-	-	-	-	-	3
ARCH 402.CO2	3	3	2	1	1	2	2	2	2	1	1	3
ARCH 402.CO3	3	3	2	3	3	2	2	1	2	1	1	3
ARCH 402.CO4	3	2	3	2	2	2	1	1	2	1	1	3
ARCH 402.CO5	3	2	3	2	2	2	1	1	2	1	1	3
Average	3	2.4	2.2	2	2.2	2	1.5	1.25	2	1	1	3

3: Strong Association, 2: Average Association, 1: Low Association

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

College of Architecture

Subject Code: ARCH 403	*Category: Architecture*
Subject Name: History of Architecture-II (Islamic)	*Semester: 3*
L-T-P: ***3-0-0***	*Credit:**3***

***Course Objectives**:*

To provide an understanding of architecture during Classical, Romanesque, Gothic and Renaissance.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	**CLASSICAL GREECE** *Abundance of high quality limestone & marble, scarcity of hardwood, restriction on building spanning, expression of direct democracy, Mediterranean climate – leading to – Columnar & Trabeated architecture, Human Scale, Extrovert Space — Orders: Doric, Ionic, Corinthian — Elements of urban architecture: Acropolis at Athens with idea about agora, stoa, bouleutorion, theatre, odeion, stadium, hippodrome and gymnasia — Detail study of the Parthenon, the temple to Athena with emphasis to its (a) Elevation: facade treatment, proportion (Golden section, optical correction); (b) Plan: pronaos, naos & statue and opisthodomos or epinaos.*	*6*
	CLASSICAL ROME - *Introduction of fired brick, use of improved mortar analogous to modern concrete, judicious use of different quality of stone, stucco & marble veneering; knowledge of true arch, barrel & cross vaults, cupola & coffer ceiling, expression of majesty of the Imperial Empire, financial resources from conquests – leading to – arcuated architecture, monumental scale, grandeur, introvert space — Orders added: Tuscan and Composite or Roman — Comparative proportions of the Classical Orders — Idea about the temples, forum, basilicas, thermae & balneae, theatre, amphitheatre, circuses, triumphal arches & columns, aqueducts & bridges — Detail study of the Pantheon, Rome with emphasis to section through its great dome.*	*6*
	BYZANTINE ARCHITECTURE *Difference in the nature of Christ, knowledge of placing a dome over a regular polygonal plan with pendentive, two axes – leading to – Orthodox Churches with square plan, enclosing nave & aisle in the shape of Greek Cross, use of large opening creating radiant interior — Detail study of the Hagia Sophia, Constantinople.*	*3*
2	**ROMANESQUE ARCHITECTURE** *Pre-Romanesque Architecture -- Examples of Frankish buildings; Imperial styles -- Carolingian art, Ottonian art; Regional styles -- Croatia, England, France, Spain and Portugal, Italy;* *First-Romanesque Architecture -- Consolidation of Papal hierarchy, desire to articulate, to stress or underline every structural division in order to produce unified compositions, continuing development of stone vaulting into groined systems – leading to – development of church plan as a Latin Cross with addition of transepts, extension of aisles carried round apsidal sanctuary to form ambulatory, figurative & non-figurative sculptures designed and integrated with structure & construction — Detail study of the Pisa Cathedral with Baptistery & Campanile.*	*6*
3	**GOTHIC ARCHITECTURE** *The term "Gothic" -- Definition and scope, Influences -- Political, Religious, Geographic; Architectural background -- Romanesque tradition, Islamic influence; Architectural development -- Abbot Suger, Transitional Period; Characteristics of Gothic churches and cathedrals -- Plan, Structure: the pointed arch -- Origins, Functions, Height, Vertical emphasis, Light, Majesty, Basic shapes of Gothic arches and stylistic character, Lancet arch, Equilateral arch, Flamboyant arch, Depressed arch; Symbolism and ornamentation; Regional differences -- France, England, Germany and Central Europe, Spain and Portugal, Italy; — Detail study of the Notre Dame, Paris with emphasis to its Plan showing nave & choir and, (b) transverse section showing pointed arch, flying buttress, nave arcade & triforium.*	*6*
4	**RENAISSANCE ARCHITECTURE**	*6*

	Historiography; Principal phases; Characteristics of Renaissance architecture; Influences on the development of Renaissance architecture in Italy; Development of Renaissance architecture in Italy - Early Renaissance -- Brunelleschi, Michelozzo, Alberti; The Spread of the Renaissance in Italy; High Renaissance -- Bramante, Sangallo, Raphael; Mannerism -- Peruzzi, Giulio Romano, Michelangelo, Giacomodella Porta, Andrea Palladio; Progression from Early Renaissance through to Baroque; Spread of Renaissance architecture beyond Italy -- France, Netherlands, England, Scandinavia, Germany, Spain, Portugal, Poland, Hungary, Russia, Croatia; Legacy of Renaissance architecture; Detail study of the evolution of the plan of the Cathedral of St. Peter, Rome — Baroque: movement, spatial invention, drama and freedom of detail – Detail study of Piazza of St. Peter, Rome.	
5	**BAROQUE ARCHITECTURE** *Precursors and features of Baroque architecture -- The Baroque and colonialism; Italy -- Rome and Southern Italy, Northern Italy; Malta; Spain; Spanish America and territories; Portugal and Portuguese Empire; Hungary; Transylvania; France; The Low Countries -- Southern Netherlands, Northern Netherlands; England; Holy Roman Empire; Polish– Lithuanian Commonwealth; Russia; Ukraine; Scandinavia; Turkey.*	*3*

Course Outcomes:

1. Understand the role of geography, society and existing knowledge on architectural solutions (with respect to Europe and Mediterranean region from 800BC to 18th C AD)
2. Learn about different building types and their design challenges and solutions with respect to specific purposes of the time and place (with respect to Europe and Mediterranean region from 800BC to 18th C AD)
3. Learn to draw and read drawings of different buildings and buildings elements (with respect to Europe and Mediterranean region from 800BC to 18th C AD)
4. Learn to express graphically, in writing, orally, in live presentation - concepts learned and internalised and how to relate them to other contexts (with respect to Europe and Mediterranean region from 800BC to 18th C AD)
5. Application of knowledge from history in present cases and the student's personal design projects (with respect to Europe and Mediterranean region from 800BC to 18th C AD)

PO → *CO ↓*	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
ARCH403-CO1	3	-	-	-	2	3	3	-	3	-	-	3
ARCH403-CO2	3	-	-	-	2	3	3	-	3	-	-	3
ARCH403-CO3	3	-	-	-	2	3	-	-	3	-	-	3
ARCH403-CO4	3	-	-	-	2	3	-	-	3	3	-	3
ARCH403-CO5	3	-	-	-	3	3	3	3	3	-	-	3
Average	3	-	-	-	2.2	3	3	3	3	3	-	3

PO1: Engineering Knowledge
PO2: Problem Analysis
PO3: Design/Development of Solutions
PO4: Conduct Investigations of Complex Problem
PO5: Modern Tool Usage
PO6: The Engineer and Society

PO7: Environment and Sustainability PO8: Ethics
PO9: Individual and Team Work
PO10: Communication
PO11: Project Management and Finance
PO12: Life-long Learning

Department of Architecture

Subject Code: ARCH 404	Category: Departmental Course
Subject Name: Materials and Construction III	Semester: **IV**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

To acquaint the students with constructional systems and detailing of Doors, windows, various types of Hardware, their fixing details, various types of Adhesives, and their uses. They will also learn about various types of Finishing materials for internal and external components of a building and about details of Staircases.

Course Content:

Module No		Contact Hrs.
1	**Door –** Types of doors based on operation **–** Swing door, Revolving door, Sliding door, Sliding-folding door, Collapsible door, Rolling shutter door; Timber doors **–** Battened, Panelled & glazed door – Flush door; Steel doors – Collapsible door, Rolling shutter; Aluminium doors**:** Swing door – Sliding door; PVC/UPVC door; Fire door. **Window –**Types of windows, based operation and Location – Fixed window, Casement window, Sliding window, Pivoted window, Louvered (or Venetian) window, Bay window, Clerestory window, Corner window – Gable and Dormer window. Timber windows – Panelled & glazed timber casement window; Steel windows – Glazed fixed & casement steel window; Aluminium windows – Casement and Sliding aluminium window; UPVC window.	9
2	**Hardware –** Fixing and fastening for doors and windows – Nails, Screws, Hinges, Bolts, Rivets, Handles etc. **Adhesives**- Characteristics, Properties, Uses, Types.	6
3	**Cost Effective Construction Techniques** - Introduction to cost effective and environmentally friendly building materials such as Stabilized mud blocks, course on vernacular approach.	6
4	**Finishes (Internal & External – Floors, Walls, Ceiling)-**Characteristics, Properties, Uses, Types. -Mud flooring, Stone flooring, other flooring in mosaic, terrazzo, ceramic tiles, vitrified tiles, wooden and polished concrete flooring. Paints, Plastering (Internal and External) Glazes and Varnishes, different finishes for building components with stone, bamboo, lime and mud different types, composition, characteristics and uses of paints enamels, distemper, plastic emulsion, polyurethane, special paints such as fire retardant, luminous	9

	and bituminous paints, Gypsum and POP, Plastering materials.	
5	**Stairs -** Components and requirements; Classification based on form, structural systems, calculations, escape route, travel distance, materials including metal Staircase, typical construction details such as balustrade fixing, nosing, etc, Railing details. Components and requirements; Classification based on form, structural systems, calculations, escape route, travel distance, materials including metal Staircase, typical construction details such as balustrade fixing, nosing, etc, Railing details.	6

COURSE OUTCOMES (CO): COURSE OUTCOME (CO)	DESCRIPTION
CO1	Knowledge about various types of doors and windows used for construction and their methods of fixing and applicability of different types of door and windows under different scenarios/situations arising in construction sites. Also, learning about the aesthetic values of such types of doors and windows.
CO2	Knowledge about various types of hardware used in fixing the doors and windows studied in earlier module, and learning about various types of adhesives and their properties and applicability or use in different situations arising in construction sites.
CO3	Knowledge and usability of various types of alternate and cost-effective construction techniques which can be more economic solutions to various situations of constraint arising in constructions sites, instead of regular materials of construction.
CO4	Knowledge about various types of flooring materials, paints, learning about techniques of plastering including special techniques, properties of such materials and their use and applicability in various situations arising in construction sites.
CO5	Knowledge about different types of staircases based on their geometric form and classifications on terms of materials by which the stairs are constructed. Learning about various types of structural systems applied while constructing stairs and various types of construction details of parts of such staircases, like balustrades and railings.

Course Outcomes:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 504.CO1	3	3	3	-	_	3	2	-	-	-	2	3
ARCH 504.CO2	3	3	3	2	2	3	2	_	_	_	2	3
ARCH 504.CO3	3	3	3	2	_	3	3	_	-	_	2	3
ARCH 504.CO4	3	3	3	2	_	3	3	_	_	-	2	3
ARCH 504.CO5	3	3	3	3	_	3	2	-	_	_	2	3
Average	3	3	3	2.25	-	3	2.5	-	-	-	2	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

<u>OmDayal Group of Institutions</u>
Department of Architecture

Subject Code: ARCH 502	Category: Bachelor in Architecture
Subject Name: BUILDING SERVICES I	Semester: V
L-T-P: 3-1-0	Credit: 3

Course Objectives:
To impart knowledge required for understanding the building services of water supply, sanitation and their integration with architectural design by studying layout of simple drainage systems for small buildings, planning of bathrooms and lavatory blocks in domestic and multi-storied buildings. Exercises of water supply & drainage layout for the ongoing studio project

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Elements of public water supply system: Sources of water, water quality, pumping and transportation of water. Conventional water treatment sedimentation, coagulation, filtration and disinfection.	6
2	Distribution system, building service connections: cold and hot water distribution systems in buildings and their design ,direct and indirect systems, special installation in multistoried buildings. Types of fixtures and materials- wash basins, water closets, urinals, bidets, sinks etc. storage reservoirs. Conditions of flow in building supply &drainage pipes.	6
3	Traps and vents; Design of drainage and vent pipes, system for low-rise and high-rise buildings, storm water drainage, design of storm drains, building drains, sewers, gully traps, inspection chambers, manholes, connection to public sewer.	6
4	Waste-water disposal systems, septic tank, soak pits and anaerobic filters, on-site processing and disposal methods. Solid wastes collection and removal from buildings. Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors,	6
5	Vacuum pump – their selection, installation and maintenance – Hot water boilers – Social features required for physically handicapped and elderly – Laboratory Service – Gas, water, Air and Electricity.	12

Course Outcomes:
1. Understanding the concept and techniques of elements of public water supply system – source of water, making raw water usable through various steps of water treatment.
2. Understand the domain of applications of storage & conveyance of treated water to buildings & their design & have detail knowledge of various sanitary fixtures.
3. Learn about house drainage system and their applications including soil waste & rain water, various methods of storm water drainage systems to the ongoing design project at the studio.
4.Having detail understanding & application of waste water treatment & disposal, Learning different methods of solid waste management.
5. Understand various pumps & their applications. Understand & apply social issues like barrier-free toilet designs for elderly & differently able people.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 502. CO1	3	_	_	_	_	3	3	3	3	2	_	3
ARCH 502. CO2	3	3	3	2	_	3	3	3	3	2	_	3
ARCH 502. CO3	3	3	3	1	_	3	3	3	2	2	_	3
ARCH 502. CO4	_	_	_	_	_	_	_	_	_	_	_	_
ARCH 502. CO5	_	_	_	_	_	_	_	_	_	_	_	_
Average	3	3	3	1.5	_	3	3	3	2.5	2	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Architect and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

MAPPING CORRELATION	**LOW**	**MEDIUM**	**HIGH**
	1	**2**	**3**

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH 503	Category: Architecture course
Subject Name: History of Architecture	Semester:**V**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:
To provide an understanding and appreciation of Modern trends in Indian and Western Architecture in terms of Ideas and directions.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Palladian Architecture:** Palladian Architecture -- Palladio's architecture; The Palladian window; Early Palladianism; Neo-Palladian -- English Palladian architecture, Irish Palladianism, North American Palladianism, Eastern European Palladianism; Decline of Palladianism.	6
2	**Neo classical Architecture:** Neoclassical Architecture -- Origins; Characteristics; Regional trends -- Spain, Polish-Lithuanian Commonwealth; Interior design; City Planning; Late phase -- United States; Neoclassical Architecture in Washington D.C. and Virginia -- Key Concepts, History, Ancient Roman Influence -- Political, Aesthetic, Intellectual; Notable Examples; List of other architectural institutions (throughout the United States); Architecture in the former Union of Soviet Socialist Republics,China and other communist countries; Great Britain, The Third Reich; Canada; Neoclassicism today.	6
3	**Emergence of Modern Architecture:** Reasons for the evolution of Modern Architecture, origins-Neo Classicism-Enlightenment, Social revolutions, Historiography, Revivalism-Works of Soane, Ledoux, Boulee Durrand & Schninkel. Industrial revolution and its impact – Emergence of new building typologies-New Materials and Technologies: history of steel ,glass and Concrete.	6
4	**Emergence of different styles in Modern Architecture:** Arts & Crafts movement in Europe and America; Art nouveau, and the works of Horta, Guimard, Gaudi and Macintosh; Organic Architecture -Early works of F.L.Wright. Chicago school; Art deco Architecture in Europe and America.	9
5	**Different styles in Modern Architecture:** Viennese secession, Adolph Loos and debates on ornamentation; Futurism, Expressionism works of Mendelssohn &Taut, Cubism, Constructivism, De stijl and their influence on Architecture. Bauhaus school & Walter Gropius, Modernism and the International style.	9

Course Outcomes:
1. Understanding the concept of palladianArchitecture and the philosophy behind it with notable examples..
2. Understanding and studying the history of Neo classical Architecture and its importance in some of the iconic buildings of the world.
3. Understanding and studying the history of Emergence of Modern Architecture and reasons which led to the theory.
4. Studying the different styles of modern architecture by different Architects or Group of architects and the Philosophy behind them with Notable examples.
5. Studying the different styles of modern architecture further which started questioning the theory of ornamentation

and further led to formation of more styles of Modern Architecture.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH503.CO1	3	-	-	-	1	2	-	-	2	2	_	3
ARCH503.CO2	3	-	-	-	2	2	-	-	2	2	_	3
ARCH503.CO3	3	-	-	-	3	2	-	-	2	2	_	3
ARCH503.CO4	3	-	-	-	3	2	-	-	2	3	_	3
ARCH503.CO5	3	-	-	-	3	2	-	-	2	3	_	3
Average	3	-	-	-	2.4	2	-	-	2	2.4	_	3

PO1: Knowledge of Architectural History

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Architectural History and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH 504	Category: Departmental Course
Subject Name:	Semester: **V**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:
To acquaint the students with constructional practices pertaining to partitions, wall paneling and roofing materials including false ceilings, etc., modern and advanced construction materials and practices.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Partitions, wall panelling and special doors** Partitions: Construction of partition in masonry, timber and timber products, gypsum boards etc. for use in offices and restaurants. Construction and details of glazed, lightweight partitions .partially colored glass, etching of glass and its applications in building industry for both exteriors and interiors. Glass fabrication techniques, fibre reinforced composite materials and products. PVC & FRP, frameless glass doors and windows and partitions. Wooden/Steel/Aluminium sliding and folding doors and partitions. Steel doors for garages and workshops. Collapsible gate and rolling shutters, remote control systems of doors and gates. Structural glazing, aluminium composite panel cladding.	15
2	**Roofs & Roofing:** Nomenclature, Types - Lean-to-roof , Coupled roof , Closed couple roof, King Post Roof Truss, Queen Post Roof Truss, Steel trusses; Roofing materials with fixing details; Roof drainage systems and details. Roofing materials: Burnt clay tiles, slates, AC sheets, GI and Aluminium sheets. Materials for Terracing: Mud- phuska and Brick Tiles and other new systems for terracing. Suspended ceilings- purpose and construction techniques with various materials	9
3	**Prefab systems** Introduction of pre-stressing, prefabrication and systems building. Jointing, tolerances and modular coordination. Production, transportation, storage and handling of materials. Characteristics, performances and application of mechanized construction equipments. Advanced construction techniques.	9
4	**Insulation** Insulation materials – Thermal and sound insulation materials; Plastics and PVC; acoustic partitions and soft panelling	6

COURSE OUTCOMES (CO): COURSE OUTCOME (CO)	DESCRIPTION
CO1	Knowledge about various systems of partitions and the relative advantages and disadvantages of materials and methods of construction along with applicability.
CO2	Knowledge about various systems of

	panelling and special types of doors and the relative advantages and disadvantages of materials and methods of construction along with applicability.
CO3	Familiarize with systems of roofing and roofing materials
CO4	Understanding and applicability of prefab system in construction
CO5	Understanding and analysing insulation systems

Course Outcomes:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 504.CO1	3	2	2	-	_	3	3	-	-	-	2	3
ARCH 504.CO2	3	2	3	-	-	3	3	_	_	_	2	3
ARCH 504.CO3	3	2	3	-	_	3	3	_	-	_	2	3
ARCH 504.CO4	3	2	3	-	_	3	3	_	_	-	2	3
ARCH 504.CO5	3	3	3	-	_	3	3	1	_	_	2	3
Average	3	2.2	3	-	-	3	3	1	-	-	2	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

<u>OmDayal Group of Institutions</u>
Department of Architecture

Subject Code: ARCH 602	Category: Departmental Course
Subject Name: Building Services II	Semester: **VI**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:
To impart knowledge and skills related to electrical services and fire-protection systems and its integration into Architectural design

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Fundamentals of electricity, current, voltage, Power transmission and distribution via overhead lines and underground cables, Steam, Hydel, Gas and Nuclear power generation ,cities and house hold connections;	6
2	Elements of building wiring system – feeders, panel board, circuit breakers' fuses, switches etc.; Electrical symbols; Installations from meter board to individual point; Electrical wiring system; Distribution boards and layout of points; Different materials and specification; Earthing agreements; Lightning conductors;	9
3	Light and its propagation, reflection, radiation, transmission and absorption. Definitions and units of flux, solid angles, luminous intensity, brightness, different type of lamps and their properties, Fixtures and accessories used in electrical installation; Schematic layout of installations and points for different building types. Visual tasks - factors affecting visual tasks - Modern theory	6
4	Causes and spread of fire. Combustibility of materials and safety norms. Study of fire regulations, fire detection and fire-fighting equipment- smoke detectors, monitoring devices, alarm systems, etc. Design of Fire escapes for high-rise buildings, case studies of building from fire protection requirements	15

COURSE OUTCOMES (CO): COURSE OUTCOME (CO)	DESCRIPTION
CO1	Learn elementary building services of electrical services and Familiarize with a range of electrical accessories and its design consideration.
CO2	Learn illumination schemes.
CO3	Familiarize with wiring systems and design consideration of lighting schemes.
CO4	Implicate electrical services in Design.
CO5	Demonstrate an understanding of building construction as it relates to fire fighter safety, building codes, fire prevention, code inspection, and fire fighting strategy.

Course Outcomes:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 602.CO1	3	2	2	3	_	3	3	2	3	-	3	3
ARCH 602.CO2	3	3	3	3	3	3	3	_	2	_	_	3
ARCH 602.CO3	3	3	3	2	_	3	3	_	3	_	3	3
ARCH 602.CO4	3	3	3	2	_	3	3	2	2	-	3	3
ARCH 602.CO5	3	3	3	2	_	3	3	2	_	_	3	3
Average	3	2.8	2.8	2.4	3	3	3	2	2.5	-	3	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

Subject Code: ARCH 603	Category: Core Architecture Theory
Subject Name: History of Architecture V	Semester: **VI**
L-T-P: **2-1-0**	Credit:**3**

Course Objectives:

To inculcate in students, a critical and analytical approach, in understanding contemporary works of Architecture through the works of outstanding architects.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Critical Approach to Modern Architecture:** Criticisms of Modern Architecture; Post Modernism, Collage, Technology and new science	7
2	**Modern Architecture Periods:** Pop art Deconstruction, Critical Regionalism with examples from works of 2nd & 3rd generation architects.	6
3	**Modern Architecture, India:** Corbusier' works in India – Chandigarh and the Ahmadabad buildings - their influence on the modern rationalists; Louis Kahn's works in India - their influence on the empiricists	8
4	**India After Nehruvian Period:** Post-Nehruvian modernist architecture – modernism, utilitarian modernism and neo-modernism, brutalism.	6
5	**Critical Approach To Post-independence Indian Architecture:** Criticisms on the modern movement in India; countering the stigma of colonialism; Critical regionalism and the neo-vernacular; the community architectural movement; integrating the new and the old; revivalism in religious and secular buildings; revivalism and post-modernism.	8

Course Outcomes:

1. Critical Approach to Modern Architecture will enable the students to analyze and understand the modern architectural trends.
2. Students will understand the works of some stalwarts of the practice and they will be able to relate the blends between technology and design.
3. Learn different modern Architecture works in India by foreign architects.
4. Understand the effect of world architectural trends on India's context, and their influence on each other.
5. Learn and apply the concept of different School of Thoughts in Architectural practice in their own design development.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 603.CO1	1	2	3	2	_	1	1	1	_	_	_	3
ARCH 603.CO2	2	2	3	2	_	2	1	1	_	_	_	3
ARCH 603.CO3	1	1	3	3	_	2	1	_	_	_	_	3
ARCH 603.CO4	2	2	2	3	_	_	1	_	_	_	_	3
ARCH 603.CO5	2	2	2	2	_	1	1	_	_	_	_	3
Average	1.6	1.8	2.6	2.4	_	1.2	1	0.4	_	_	_	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH 604	Category: Architecture course
Subject Name: Landscape Design	Semester:**VI**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:
To motivate students to understand and develop an appreciation for role of landscape elements in an architectural design. Also study and analyze the Impact of landscape elements on the environment..Study the role of a landscape Architect and its importance.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Introduction:** Introduction to landscape architecture; role of landscape design in architecture; ecology ,concept of ecosystem , ecological balance, environmental degradation and deterioration of natural resources,	6
2	**History of gardens-1:** Landscape and garden design in history - French, English, Japanese with notable examples	7
3	**History of gardens-II:** Landscape and garden design in history -, Renaissance and Mughal . Study of notable examples.	8
4	**Landscape Elements:** Hard and soft landscape elements, Types of Plant materials, classification, characteristics, use and application in landscape design; Water and Landform. Introduction to Landscaping materials	7
5	**Urban landscape:** Significance of landscape in urban areas; road landscaping; waterfront development, landscaping of residential areas. Basic principles of planting design; Study of landscape design of any small project including paving and street furniture design.	8

Course Outcomes:
1. Understand the concept of ecology and its functioning and its impact in the surroundings.
2. Understanding and studying the history of gardens(the three kinds) and its relevance in the society
3. Understanding and studying the history of gardens(the two kinds) and its relevance in the society
4. Apply the concept and techniques of landscape design and Learn different types of Landscape elements, materials and its application.
5. Learn and apply the concept of landscaping in totality and understanding the changing scenario in urban landscape .

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 604.CO1	2.5	3	3	3	1	2	3	2	2	3	_	3
ARCH 604.CO2	2.5	-	3	3	2	2	3	2	2	2	_	3
ARCH 604.CO3	2.5	-	3	3	3	2	2	2	2	2	_	3
ARCH 604.CO4	2.5	3	3	3	3	2	2	2	2	2	_	3
ARCH 604.CO5	2.5	3	2	3	3	2	3	2	2	3	_	3
Average	2.5	1.8	2.8	3	2.4	2	2.6	2	2	2.4	_	3

PO1:Landscape Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Landscape and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Department of Architecture

Subject Code: **ARCH 701**	Category: **Professional Course**
Subject Name : Structure in Architecture	Semester: **VII**
L-S-P: **3 – 0 - 0**	Credit: **3**

PREREQUISITE: Engineering Mechanics, History of Architecture

COURSE OBJECTIVE

Students will learn the behavioural pattern of different structural systems so as to incorporate those in their design.

Module No.	DESCRIPTIONS OF TOPIC	CONTACT HOURS
Module-1	Theory of Domes, Shells, Vaults, Space Frame, Flat Slabs, Hollow Floor. & Folded Plates. (Following systems and techniques are to be understood conceptually. Calculations / Design for these techniques and systems are not expected.) Synthesis of force systems to create Structural system.	12 H
Module-2	Vector Active, Surface Active and Bulk Active systems. Portal Frame, Cables and Suspension Structures.	12 H
Module-3	Structure System for Seismic Zone, Inflatable Structures	12 H

Course Outcomes (COs):

On successful completion of this course, student should be able to

CO1. Will understand the behavioural pattern of different types of structures

CO2. Will know about the categorisation of structural systems

CO3. Gain knowledge about the application of different types of structures

CO4. Understand the modern trends in structural systems

CO5. Gain knowledge about structural types and requirements of seismic zones

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
ARCH701. 1	3	1	2	_	1	1	2	1	1	1	2	1
ARCH701. 2	3	1	2	_	1	1	2	1	1	1	2	1
ARCH701. 3	3	1	2	_	1	1	2	1	1	1	2	1
ARCH701. 4	3	1	2	_	1	1	2	1	1	1	2	1
ARCH701. 5	3	1	2	_	1	1	2	1	1	1	2	1
Average	3	1	2	-	1	1	2	1	1	1	2	1

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH 702	Category: Core Architecture Theory
Subject Name: Building Services III	Semester: **VII**
L-T-P: **2-1-0**	Credit:**3**

Course Objectives:
To understand the schematic layout of simple air conditioning system for domestic and office buildings. Understanding of operations and use of lifts and escalators

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Thermodynamics, Fluid flow, Heat Transfer, Psychometric chart, comfort zone. Selection of indoor and outdoor design conditions. Air conditioning systems, evaporative, winter and all-year air conditioning systems	7
2	Refrigeration cycle and air cycle. Standards and prescribed locations for various parts. Descriptive details of plants and duct layout. Air distribution system- fans, filters, ductwork, outlets, dampers.	6
3	Cooling and heating load calculations; Cooling load for AC.	4
4	Natural and artificial ventilation. Application to a selected project, and case analysis of selected project	7
5	Types of lifts, their control and operation. Definition of average lift carrying capacity, rated load, rated speed, RTT etc. Details of lift section, machine room, equipment, lift well and lift pit. Design standards for lifts lobby, lift cars size etc from building codes. Escalators and conveyors.	12

Course Outcomes:
CO 1: Understand basic principles of thermodynamics in relation to HVAC services. Understand the psychometric processes with the help of psychometric chart. Climatic considerations for various design conditions and locations. Learn about multiple types of Air-conditioning systems for different design conditions and application scenarios.
CO 2: Understand the different refrigeration cycles and their use case. Understand duct layout design for proper artificial ventilation within a confined conditioned space.
CO 3: Understand and learn the methods of heating or cooling load calculation for different types of buildings.
CO 4: Understand natural and artificial ventilation for buildings. Learn various ideologies and context of designs thereby developing their own theories and applying the same knowledge in their own design skills.
CO 5: Understanding of working of Lift and escalator as a mechanical device. Develop an understanding of local codes in reference to the topics of this course

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH 702.CO1	3	2	2	1	2	2	2	1	2	1	1	3
ARCH 702.CO2	3	3	3	2	3	2	2	1	2	1	1	3
ARCH 702.CO3	3	1	2	2	2	1	2	-	1	1	-	3
ARCH 702.CO4	2	2	2	1	2	2	2	1	2	2	-	3
ARCH 702.CO5	3	2	3	2	3	2	2	1	2	1	1	3
Average	2.8	2	2.4	1.6	2.4	1.8	2	1	1.8	1.2	1	3

3: Strong Association, 2: Average Association, 1: Low Association

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Basic Science and Humanities

Subject Code: **ARCH703**	Category: **Professional Core courses**
Subject Name: **Building Economics and Construction Management**	Semester: VII
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:

To provide an insight into Economics and it's influence on the business of Architecture and management of Construction Projects involving management of money, manpower, machinery and time

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Elements of Economics: An idea of fundamental concepts of economics Science and their application in Construction industry. Micro Economics: Utility analysis, demand & supply Factor of production Characteristics and importance, short run and long run production function , law of variable proportions , law of returns to scale , Cost – upto long run marginal cost , Market overview –Perfect competition, monopoly & Monopolistic Macro Economics: National income and its distribution, inequalities of income distribution, its causes and measures ,	9
2	Cost sheet, Capital Budgeting –Payback period, discounted payback period, payback profitability, Net present value Ratio Analysis – Idea of trading A/C, Profit & loss A/C and Balance sheet, Basic ratios	9
3	Project planning and project scheduling and project controlling, Role of Decision in project management, Method of planning and programming, Human aspects of project management, work breakdown structure, Life cycle of a project, disadvantages of traditional management system	9
4	Event, activity, dummy, network rules, graphical guidelines for network, numbering of events. CPM network analysis& PERT time estimates, time computation & network analysis Project cost, Indirect project cost, direct project cost, slope of the direct cost curve, Total project cost and optimum duration, contracting the network for cost optimization, steps in cost-time optimizatio	9

Course Outcomes:

On completion of the course students will be able to

1. Develop ideas of the basic characteristics of Indian economy, its potential on natural resources.

2. Define and explain the process of calculating national income, identify its components, demonstrate circular flow of income, analyse the various income identities with government and international trade, define the concept of green accounting.

3. Create construction project cost estimates. Understand construction risk management.

4. Apply the concepts of financial management for project appraisal

5. Describe the time needed to successfully complete a project, considering factors such as task dependencies and task lengths

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH703.CO1	-	2	-	-	-	-	-	-	-	-	1	3
ARCH703.CO2	-	3	-	-	-	-	2	-	-	-	3	3
ARCH703.CO3	3	3	3	3	2	3	3	-	-	2	3	3
ARCH703.CO4	-	3	2	-	-	-	-	-	-	-	3	3
ARCH703.CO5	-	3	3	-	-	-	-	-	-	2	3	3
Average	3	2.8	2.67	3	2	3	2.5	-	-	2	2.6	3

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH - 704	Category: Architecture Course
Subject Name: Urban Planning & Human Settlement	Semester: **VII**
L-T-P: **3-0-0**	Credit:**3**

Course Objectives:
To give an introduction to Human Settlements Planning and to develop skills for carrying out surveys, analysis, presentation with respect to problems faced in order to improve them.
Course Content:

Module No	Description of Topic	Contact Hrs.
1	**Human Settlement**: Man, and Environment, Biological and behavioural responses to human settlements. History of human settlements, Role of River Banks in growth of human settlement. Western world: River valley settlements, Greek, Roman, Medieval, Renaissance and modern	12
2	**Ancient Indian Cities:**Indus valley civilization - Mohenjodaro, Harappa, Extracts from Chanakya’s Arthasastra, Manasara’s Silpa Shastra, Vast shastra, planning thought behind Fatehpursikhri, Shahjahanabad, Jaipur and Delhi	6
3	**Contemporary Cities:** Studies of selected examples to include concentric city, radiant city, CIAM, linear industrial city and contemporary India Cities.	6
4	**Post Industrialization:** Planning concepts related to Garden City, Geddesian triad, neighbourhood planning, Radburn layout, ekistics, satellite towns and ribbon development.	6
5	**Planning Process**: Definitions of town planning, levels of planning and steps for preparation of a town plan, survey techniques in planning, concepts, functions, components and preparation of a development plan. Concepts in Regional and Metropolitan planning, land subdivision regulations and zoning, nature of regulations and control, the comprehensive role of urban design in town planning process	6

Course Outcomes:
1. The student will gain knowledge about the nature, characteristics and evolution of human settlements
2. the planning concepts of historical and contemporary towns.
3. Learn and apply Theory of Urban Planning and evolution of cities.
4. knowledge of Application of urban planning theory through case studies and its advantages - disadvantages
5. They will be aware of the current issues in urban planning and will be acquainted with land-use, zoning, types of development plan, etc.

	Urban Planning and Human Settlement											
	ARCH - 704 : Programme Outcomes											
CO-PO	Engineering Knowledge	Problem Analysis	Design/ Development of Solutions	Conduct Investigations of Complex Problems	Modern Tool Usage	The Architect ure and Society	Environment and Sustainability	Ethics	Individual and Team Work	Communic ation	Project Managem ent and Finance	Life-long Learning
Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C203-1	-	2	1	1	-	1	2	-	1	1	-	2
C203-2	-	2	1	1	-	1	2	-	1	1	-	2
C203-3	-	3	1	1	-	1	1	-	-	1	-	3
C203-4	-	1	-	1	-	1	2	1	-	1	-	3
C203-5	1	3	2	2	-	2	3	3	1	1	2	3
Average	1	2.2	1.25	1.2	-	1.2	2.0	2	1	1	2	2.6

Mapping Corelation	Low	Medium	High	No
	1	2	3	-

PO1: Engineering Knowledge

PO2: Problem Analysis

PO3: Design/Development of Solutions

PO4: Conduct Investigations of Complex Problems

PO5: Modern Tool Usage

PO6: The Engineer and Society

PO7: Environment and Sustainability

PO8: Ethics

PO9: Individual and Team Work

PO10: Communication

PO11: Project Management and Finance

PO12: Life-long Learning

OmDayal Group of Institutions

Department of Architecture

Subject Code: **ARCH 801**	Category: **Professional Course**
Subject Name : Energy Efficient Architecture	Semester: **VIII**
L-S-P: **3 – 0 - 0**	Credit: **3**

PREREQUISITE: History of Architecture, Services, Materials and Construction, Climatology

COURSE OBJECTIVE

Students will learn the behavioural pattern of different structural systems so as to incorporate those in their design.

Module No.	DESCRIPTIONS OF TOPIC	CONTACT HOURS
Module-1	Land form & orientation – Vegetation & Pattern – Water Bodies – Open Space & Built form - Plan form & Elements – Roof form – Fenestration pattern & Configuration – Building envelope & finishes	9 H
Module-2	Solar System and Earth - Renewable Sources of Energy - Global Climates and Architecture in Historic Perspective.	9 H
Module-3	Ozone layer depletion, Global Warming and effects of pollution. Heating & cooling loads – Energy estimates - Energy conservation – Efficient day lighting – Solar Water heating system. Exercises on heating and cooling load calculations in buildings	9 H
Module-4	Contemporary Trends - Sustainability and Architecture, ECBC guidelines and recommendations, Green buildings audits criteria, various ratings systems and accreditations	9 H

Course Outcomes (COs):

On successful completion of this course, student should be able to

CO1. Will understand the various factors effecting Energy demand of buildings

CO2. Will understand the effects of Solar system and renewable energy

CO3. Gain knowledge about sustainable architecture and green rating systems

CO4. Learn to calculate energy demand of a building

CO5. Will be capable of designing Energy efficient and sustainable buildings

Mapping of Course outcomes with Program outcomes

PO/ PSO Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
ARCH701. 1	2	2	3	_	2	1	3	2	1	-	2	2
ARCH701. 2	2	2	3	_	2	1	3	2	1	-	2	2
ARCH701. 3	2	2	3	_	2	1	3	2	1	-	2	2
ARCH701. 4	2	2	3	_	2	1	3	2	1	-	2	2
ARCH701. 5	2	2	3	_	2	1	3	2	1	-	2	2
Average	2	2	3	-	2	1	3	2	1	-	2	2

1: Slightly 2: Moderately 3: Substantially

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH 802	Category: Architecture
Subject Name: Housing & Community Planning	Semester: **8**
L : 3/wk	Credit:**3**

Course Objectives:
To understand the fundamentals of housing design
Methodology : Lecture-presentations, interactive sessions, site survey and data assimilation.

Course Content:

Module No	Description of Topic	Contact pds.
1	Review of different forms of housing globally – particularly with reference to third world countries. Housing need & Demand – Calculation of future need. Housing resources and options available in housing Housing Agencies and their contributions to housing development – HUDCO, State Housing Boards, Housing Co-operatives and Banks. Housing Policies in India and other countries like UK & USA.	6 pds
2	Social factors influencing Housing Design, affordability, economic factors and housing concepts – Slum upgrading and sites and services schemes. Social problems and programmes: Urban society – Social and economic problems; Rural society: Social and economic problem Developmental programs- urban and rural.Impact of programmes on social development. Different types of Housing standards – Methodology of formulating standards – Relevance of standards in Housing Development..	18 pds
3	Different stages in project development – Layout design including utilities and common facilities – Housing design as a result of environmental aspects, development of technology and community interests. Case studies of Public Sector housing, Government housing, Private and Co-operative housing – their Advantages and disadvantage	12 pds

Course Outcomes:
1. To know the different forms of housing especially applicable to economically weaker section of people.
2. To be aware of the different housing agencies and their contribution in housing development programs.
3 To understand the influence of socio-economic factors on housing and community development.
4. To be able to develop relevant design modules.
5. To understand public –private partnership in developmental projects.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C802-1	3	3	3	3	2	2	1	2.5	2.5	---	---	3
C802-2	3	--	1	1	2	2	1.5	1.5	1.5	----	3	2
C802-3	2	2.5	2	2.5	_	3	2	3	2.5	2.5	_	3
C802-4	2	2.5	2.5	2.5	3	3	3	3	3	3	3	3
C802-5	2.5	2	2	1	--	1	1.5	2	----	--	3	3
Average	2.5	2	2.1	2.0	1.4	2.2	1.8	2.4	1.9	1.1	1.8	2.8

OmDayal Group of Institutions

Department of Architecture

Subject Code: ARCH 803	Category: Architecture
Subject Name: Urban Design	Semester: **8**
L-T-P: **3-1-0**	Credit: **3**

Course Objectives:

To familiarize students with the aspects of Urban design and to provide introductory knowledge of Urban design.

Course Content:

Module No	Description of Topic	Contact Hrs.
1	Emergence of urban design as a discipline- Concepts and parameters of urban design, Urban scale, mass and space: understanding components of urban fabric, Making a visual survey, understanding the various spaces in the city and their hierarchy- Spaces for residential, commercial, recreational and industrial use.	6
2	Special focus on streets, Expressive quality of built forms, spaces and form in public domain including spatial organization- transformation of building fabric, study of patterns and characteristics including skyline analysis & their sectional relationship : special focus on graphical representation	6
3	A brief analysis of urban spaces in history – in the West (Greek, Roman, Medieval & Renaissance towns) and the East (Vedic, temple towns, medieval and Islamic towns).	9
4	Relevance of the historical concepts in the present context, critical analysis of some Indian cities	6
5	Understanding Urban renewal and the need for it, Scope, challenge and implementation methods, Public participation, Townscape policies and urban design guidelines for new developments-Case studies- Analytical study of micro level urban design projects with special focus on site survey. Pathway analysis including serial vision, figure ground relationships with more emphasis of circulation of spaces and their inter-linkages	9

Course Outcomes:

1. Initiating students in theory and understanding of Urban design holistically.
2. Obtaining insight into the evolutionary process of Urban design and emphasizing on streets and the spatial pattern of built forms.
3. Extending substantial knowledge of urban spaces in the history of West and the East.
4. Understanding various issues related to urban design and their related historical concepts along with study and analysis of some developed cities of India.
5. Generic discussion on Urban renewal and discussion of related case studies from urban design context at both micro and macro levels.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ARCH803.CO1	3	3	3	2	_	1	2	_	3	2	_	3
ARCH803.CO2	3	3	3	3	_	1	2	_	_	2	_	3
ARCH803.CO3	3	3	2	2	_	1	_	_	_	2	_	3
ARCH803.CO4	3	3	3	3	_	1	_	_	_	2	_	3
ARCH803.CO5	3	3	3	3	_	1	_	_	_	2	_	3
Average	3	3	2.8	2.6	_	1	_	_	_	2	_	3

Subject Code : Arch 804 Subject Name : Disaster Mitigation LTP : 3 – 0 - 0	Category : B.ARCH Course. Semester : 8 th Sem. Credit : 3

Course Objectives:

To raise awareness towards Disaster Resistance, impart knowledge of disaster mitigation and introduction of earthquake restant design of buildings.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1.	Introduction to basic methods of disaster resistance,Types of disasters – both Natural and Man made like Flood, Cyclone, Earthquake, pandemics, etc.	3
2.	Broad safety measures for general recurrant disasters,with reference to Architecture and in Indian context.	3
3.	Design aspects of remedial measures and resistance for various building types as, residential, institutional, congregational etc.	8
4.	Basic knowledge of Seismology, Plate tectonics, Earthquake occurances of the world, their causes, various instruments of Seismology, Characteristics of Earthquake.	12
5.	Architectural Design Concepts of Earthquake resistance, Various concepts of Disaster Management,Preparedness, Recovery,Contingency Management,Rehabilitation etc.	10

Course Outcomes :

1. Create the genaral awareness of the environment, responsibilities and readiness for combating disasters

2. Traditional and Technology based Disaster Resistance techniques, Architects' Role, and Indian scenerio.

3. Technology and Scientific solutions for various Building Types, design variations and technical toolsaccording to suitability.

4. Comprehensive knowledge of Earthquakes, its origin, , remedial measures and adoption of Scientific methods.

5. Impart knowledge of Disaster Management, Peoples' participation,International trends and Aids, Modern concepts,Capacity Building.

PO CO	PO1 Engineering Knowledge	PO2 Problem Analysis	PO3 Design/ Development of solutions	PO4 Conduct investigations of complex problems	PO5 Modern Tool usage	PO6 The Engineer and Society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual and Team work	PO10 Communi cation	PO11 Project Manageme nt and Finance	PO12 Life-long Learning
CO1	1	1	-	-	2	2	2	1	-	-	-	3
CO2	2	2	2	1	2	2	2	3	1	3	2	3
CO3	3	3	3	3	3	3	2	2	3	2	1	3
CO4	2	1	-	-	1	1	-	-	-	2	-	3
CO5	3	3	2	3	1	2	3	3	3	3	3	3
Aver age	2.2	2	1.4	1.4	1.8	2	1.8	1.8	1.4	2	1.4	3

OmDayal Group of Institutions

College of Architecture

Subject Code: ARCH 1001d	*Category: Architecture*
Subject Name: INDUSTRIAL ACHITECTURE	Semester: 10
L-T-P: ***3-0-0***	*Credit:**3***

***Course Objectives**:*

To provide an understanding of special design guidelines for barrier free architecture.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	• *General :* o *Industrial Estates* o *requirements of factory act and codes* o *classification of industrial occupancy* o *patterns of industrial estates* o *integrated aspects of design* o *general requirements of different types of industries*	*9*
2	• *History of factory buildings*	*6*
3	• *Architecture for industries* o *functional planning of spaces* o *plant layout - flexibility of design and future expansion* o *Industrial Structures* o *steel structures and concrete structures* o *requirements of various finishing works*	*15*
4	• *Environmental Design for Industries* o *Environmental Design for Industries* o *aspects of external environments such as noise control regulations, pollution levels, sewage disposal and hygiene* o *factory and landscape* o *layout and organisation of industrial townships.*	*9*

Course Outcomes:

1. Learn in general :
    - *Industrial Estates*
    - *requirements of factory act and codes*
    - *classification of industrial occupancy*
    - *patterns of industrial estates*
    - *integrated aspects of design*
    - *general requirements of different types of industries*
2. Learn about history of factory buildings
3. Learn about architecture for industries
    - *functional planning of spaces*
    - *plant layout - flexibility of design and future expansion*
    - *Industrial Structures*
    - *steel structures and concrete structures*
    - *requirements of various finishing works*
4. Learn about environmental Design for Industries
    - *Environmental Design for Industries*
    - *aspects of external environments such as noise control regulations, pollution levels, sewage disposal and hygiene*
    - *factory and landscape*

- *layout and organisation of industrial townships.*

5. Able to do (a) Case study from real projects, (b) application in final year thesis project

PO → *CO ↓*	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*		*PO9*	*PO10*	*PO11*	*PO12*
ARCH1001d-CO1	3	-	-	-	3	3	-	3		-	-	-	3
ARCH1001d-CO2	3	-	-	-	3	3	-	-		-	-	-	3
ARCH1001d-CO3	3	-	-	-	3	3	-	-		-	-	-	3
ARCH1001d-CO4	3	-	-	-	3	3	-	-		-	-	-	3
ARCH1001d-CO5	3	3	3	3	3	3	3	3		3	3	-	3
Average	3	3	3	3	3	3	3	3		3	3	-	3

PO1: Engineering / architectural Knowledge
PO2: Problem Analysis
PO3: Design/Development of Solutions
PO4: Conduct Investigations of Complex Problem
PO5: Modern Tool Usage
PO6: The Engineer and Society
PO7: Environment and Sustainability PO8: Ethics
PO9: Individual and Team Work
PO10: Communication
PO11: Project Management and Finance
PO12: Life-long Learning

OmDayal Group of Institutions

College of Architecture

Subject Code: ARCH 1001e	*Category: Architecture*
Subject Name: BARRIER FREE ACHITECTURE	Semester: 3
L-T-P: ***3-0-0***	*Credit:* ***3***

Course Objectives:

To provide an understanding of special design guidelines for barrier free architecture.

Course Content:

Module No	*Description of Topic*	*Contact Hrs.*
1	Types of disabilities and its implications in Architecture, barrier free environment, access-provisions to facilities and amenities.	*5*
2	Special design considerations in residential buildings, congregational buildings like auditoriums, theatres, studios, transport terminals etc., Institutional buildings, outdoor appurtenances, garden, parks etc.	*16*
3	Study of norms set by Central Government	*18*

Course Outcomes:

1. Learn the basics of barrier and disability definitions and different national and international policies and statues
2. Learn about principles of barrier free design and universal design, about different national and international policies and statues regarding barrier, barrier free design and universal design
3. Learn about general architectural requirements of barrier free design and universal design
4. Learn about general architectural requirements for purpose-specific buildings
5. (a) Case study from live projects, (b) application in final year thesis project

PO → *CO ↓*	*PO1*	*PO2*	*PO3*	*PO4*	*PO5*	*PO6*	*PO7*	*PO8*	*PO9*	*PO10*	*PO11*	*PO12*
ARCH1003e-CO1	3	-	-	-	3	3	-	3	-	-	-	3
ARCH1003e-CO2	3	-	-	-	3	3	-	-	-	-	-	3
ARCH1003e-CO3	3	-	-	-	3	3	-	-	-	-	-	3
ARCH1003e-CO4	3	-	-	-	3	3	-	-	-	-	-	3
ARCH1003e-CO5	3	3	3	3	3	3	3	3	3	3	-	3
Average	3	3	3	3	3	3	3	3	3	3	-	3

PO1: Engineering / architectural Knowledge
PO2: Problem Analysis
PO3: Design/Development of Solutions
PO4: Conduct Investigations of Complex Problem
PO5: Modern Tool Usage
PO6: The Engineer and Society
PO7: Environment and Sustainability PO8: Ethics
PO9: Individual and Team Work
PO10: Communication
PO11: Project Management and Finance
PO12: Life-long Learning

OmDayal Group of Institutions
Department of Architecture

Subject Code: ARCH 1002b	Category: Architecture
Subject Name: Vernacular Architecture	Semester: **10**
L : 3/wk	Credit:**3**

Course Objectives:
To understand the indigenous methods in architecture

Course Content:

Module No	Description of Topic	Contact pds.
1	Approaches and concepts to the study of Vernacular architecture – Introduction to Kutcha architecture and Pucca architecture. Planning aspects, materials of construction, Constructional details & Settlement Planning of various regions Religious practices, beliefs, culture & climatic factors influencing the planning of the above	36 pds

Course Outcomes:
1. To know the organic development of architecture.
2. To be aware of the diversities in vernacular treatments
3 To understand the influence of socio-economic factors on habitation design
4. To be able to adopt the sustainable approach of vernacular concepts.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C802-1	3	1	3	3	------	3	3	---	2.5	2	1	3
C802-2	3	1	3	3	1	3	3	---	2.5	1.5	1	2.5
C802-3	3	2	2.5	2.5	_	3	3	2	2.5	1.5	_	3
C802-4	2.5	2.5	2.5	2.5	3	3	2.5	2	3	2	3	3
C802-5	---	---	---	---	--	--	--	--	----	--	----	---
Average	2.3	1.3	2.2	2.2	0.8	2.4	2.3	0.8	2.1	1.4	0.8	2.3