**TSSM's**

**PadmabhooshanVasantdadaPatil Institute of Technology, Bavdhan, Pune-21**

**Course Outcomes**

**Department of First Year Engineering:**

**Semester –I**

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| **CO of the Course "Engineering Mathematics-I"** | |
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| CO1 | Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems |
| CO2 | The Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems |
| CO3 | To deal with derivative of functions of several variables that are essential in various branches of Engineering |
| CO4 | functions and evaluate the limit of indeterminate forms using L'Hospital Rule |
| CO5 | The essential tool of matrices and linear algebra in a comprehensive manner for analysis of system of linear equations, finding linear and orthogonal transformations, Eigen values and Eigen vectors applicable to engineering problems |
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| **CO of the Course "Engineering Physics"** | |
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| CO1 | Develop understanding of interference, diffraction and polarization; connect it to few engineering applications |
| CO2 | Learn basics of lasers and optical fibers and their use in some applications. |
| CO3 | Understand concepts and principles in quantum mechanics. Relate them to some applications |
| CO4 | Understand theory of semiconductors and their applications in some semiconductor devices. |
| CO5 | Summarize basics of magnetism and superconductivity. Explore few of their technological applications |
| CO6 | Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterials and their application. |
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| **CO of the Course "Engineering Chemistry"** | |
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| CO1 | To understand technology involved in analysis and improving quality of water as commodity |
| CO2 | To acquire the knowledge of electro-analytical techniques that facilitates rapid and precise understanding of materials. |
| CO3 | To understand structure, properties and applications of speciality polymers and nano material |

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| CO4 | To study conventional and alternative fuels with respect to their properties and applications. |
| CO5 | To study spectroscopic techniques for chemical analysis |
| CO6 | To understand corrosion mechanisms and preventive methods for corrosion control. |
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| **CO of the Course "- Systems in Mechanical Engineering"** | |
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| CO1 | Describe and compare the conversion of energy from renewable and non-renewable energy sources |
| CO2 | Explain basic laws of thermodynamics, heat transfer and their applications |
| CO3 | List down the types of road vehicles and their specifications |
| CO4 | Illustrate various basic parts and transmission system of a road vehicle |
| CO5 | Discuss several manufacturing processes and identify the suitable process |
| CO6 | Explain various types of mechanism and its application |
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| **CO of the Course "Basic Electronics Engineering"** | |
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| CO1 | The principle of electronics and working principle of PN junction diode and special purpose diodes. |
| CO2 | The functioning of transistors like BJT, MOSFETs and OPAMP. |
| CO3 | Basics of various logic gates, digital circuits and their applications. |
| CO4 | Working and functions of various electronic instruments. |
| CO5 | The operating principles and applications of various active and passive sensors. |
| CO6 | Basic principles of communication systems |
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| **CO of the Course "Basic Electrical Engineering"** | |
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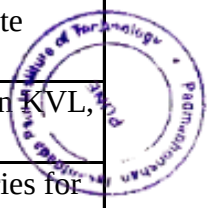
| CO1 | Differentiate between electrical and magnetic circuits and derive mathematical relation for self and mutual inductance along with coupling effect. |
| CO2 | Calculate series, parallel and composite capacitor as well as characteristics parameters of alternating quantity and phasor arithmetic |
| CO3 | Derive expression for impedance, current, power in series and parallel RLC circuit with AC supply along with phasor diagram |
| CO4 | Relate phase and line electrical quantities in polyphase networks, demonstrate the operation of single phase transformer and calculate efficiency and regulation at different loading conditions |
| CO5 | Apply and analyze the resistive circuits using star-delta conversion KVL, KCL and different network theorems under DC supply |
| CO6 | Evaluate work, power, energy relations and suggest various batteries for different applications, concept of charging and discharging and depth of charge |



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| **CO of the Course " Programming and Problem Solving"** | |
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| CO1 | Inculcate and apply various skills in problem solving |
| CO2 | Choose most appropriate programming constructs and features to solve the problems in diversified domains |
| CO3 | Exhibit the programming skills for the problems those require the writing of welldocumented programs including use of the logical constructs of language, Python |
| CO4 | Demonstrate significant experience with the Python program development environment. |
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| **Department of First Year Engineering:** | |
| **Semester –II** | |
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| **CO of the Course "Engineering Mathematics-II"** | |
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| CO1 | The effective mathematical tools for solutions of first order differential equations that model physical processes such as Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc. |
| CO2 | functions, Gamma functions, Differentiation under integral sign and Error functions needed in evaluating multiple integrals and their applications |
| CO3 | to trace the curve for a given equation and measure arc length of various curves. |
| CO4 | the concepts of solid geometry using equations of sphere, cone and cylinder in a comprehensive manner. |
| CO5 | evaluation of multiple integrals and its application to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia. |
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| **CO of the Course "Engineering Mechanics"** | |
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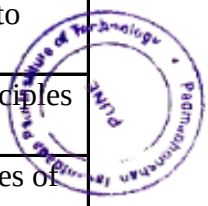
| CO1 | Determine resultant of various force systems |
| CO2 | Determine centroid, moment of inertia and solve problems related to friction |
| CO3 | Determine reactions of beams, calculate forces in cables using principles of equilibrium |
| CO4 | Solve trusses, frames for finding member forces and apply principles of equilibrium to forces in space |
| CO5 | Calculate position, velocity and acceleration of particle using principles of kinematics |
| CO6 | Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy |



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| **CO of the Course "Workshop Practice"** | |
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| CO1 | Familiar with safety norms to prevent any mishap in workshop. |
| CO2 | Able to handle appropriate hand tool, cutting tool and machine tools to manufacture a job. |
| CO3 | Able to understand the construction, working and functions of machine tools and their parts. |
| CO4 | Able to know simple operations (Turning and Facing) on a centre lathe. |
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| **CO of the Course "Engineering Graphics"** | |
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| CO1 | Draw the fundamental engineering objects using basic rules and able to construct the simple geometries |
| CO2 | Construct the various engineering curves using the drawing instruments. |
| CO3 | Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object |
| CO4 | Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment |
| CO5 | Draw the development of lateral surfaces for cut section of geometrical solids |
| CO6 | Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools. |
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| **Department of Mechanical Engineering** | |
| **Semester –I** | |
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| **CO of the Course "Solid Mechanics"** | |
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| CO1 | DEFINE various types of stresses and strain developed on determinate and indeterminate members. |
| CO2 | DRAW Shear force and bending moment diagram for various types of transverse loading and support |
| CO3 | COMPUTE the slope & deflection, bending stresses and shear stresses on a beam. |
| CO4 | CALCULATE torsional shear stress in shaft and buckling on the column. |
| CO5 | APPLY the concept of principal stresses and theories of failure to determine stresses on a 2-D element |
| CO6 | UTILIZE the concepts of SFD & BMD, torsion and principal stresses to solve combined loading application based problems. |
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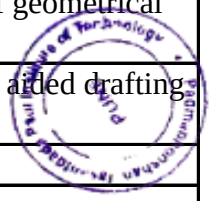
| **CO of the Course "Solid Modeling and Drafting"** | |



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| CO1 | UNDERSTAND basic concepts of CAD system, need and scope in Product Lifecycle Management |
| CO2 | UTILIZE knowledge of curves and surfacing features and methods to create complex solid geometry |
| CO3 | CONSTRUCT solid models, assemblies using various modeling techniques & PERFORM mass property analysis, including creating and using a coordinate system |
| CO4 | APPLY geometric transformations to simple 2D geometries |
| CO5 | USE CAD model data for various CAD based engineering applications viz. production drawings, 3D printing, FEA, CFD, MBD, CAE, CAM, etc |
| CO6 | USE PMI & MBD approach for communication |
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| **CO of the Course "Engineering Thermodynamics"** | |
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| CO1 | DESCRIBE the basics of thermodynamics with heat and work interactions. |
| CO2 | APPLY laws of thermodynamics to steady flow and non-flow processes. |
| CO3 | APPLY entropy, available and non available energy for an Open and Closed System, |
| CO4 | DETERMINE the properties of steam and their effect on performance of vapour power cycle. |
| CO5 | ANALYSE the fuel combustion process and products of combustion. |
| CO6 | SELECT various instrumentations required for safe and efficient operation of steam generator. |
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| **CO of the Course "Engineering Materials and Metallurgy"** | |
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| CO1 | COMPARE crystal structures and ASSESS different lattice parameters. |
| CO2 | CORRELATE crystal structures and imperfections in crystals with mechanical behaviour of materials |
| CO3 | DIFFERENTIATE and DETERMINE mechanical properties using destructive and nondestructive testing of materials |
| CO4 | IDENTIFY & ESTIMATE different parameters of the system viz., phases, variables, component, grains, grain boundary, and degree of freedom. etc. |
| CO5 | ANALYSE effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy. |
| CO6 | SELECT appropriate materials for various applications. |
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| **CO of the Course "Electrical and Electronics Engineering"** | |
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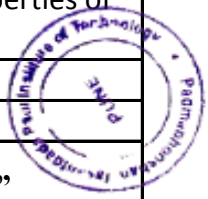

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| CO1 | APPLY programming concepts to UNDERSTAND role of Microprocessor and Microcontroller in embedded systems |
| CO2 | DEVELOP interfacing of different types of sensors and other hardware devices with Atmega328 based Arduino Board |
| CO3 | UNDERSTAND the operation of DC motor, its speed control methods and braking |
| CO4 | DISTINGUISH between types of three phase induction motor and its characteristic features |
| CO5 | EXPLAIN about emerging technology of Electric Vehicle (EV) and its modular subsystems |
| CO6 | CHOOSE energy storage devices and electrical drives for EVs |
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| **CO of the Course "Metrology and Quality Control"** | |
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| CO1 | Understand the methods of measurement, selection of measuring instruments / standards of measurement, carryout data collection and its analysis. |
| CO2 | Explain tolerance, limits of size, fits, geometric and position tolerances and gauge design |
| CO3 | Understand and use/apply Quality Control Techniques/ Statistical Tools appropriately |
| CO4 | Develop an ability of problem solving and decision making by identifying and analyzing the cause for variation and recommend suitable corrective actions for quality improvement. |
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| **CO of the Course "Heat Transfer"** | |
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| CO 1 | Analyze the various modes of heat transfer and implement the basic heat conduction equations for steady one dimensional thermal system. |
| CO 2 | Implement the general heat conduction equation to thermal systems with and without internal heat generation and transient heat conduction. |
| CO 3 | Analyze the heat transfer rate in natural and forced convection and evaluate through experimentation investigation. |
| CO 4 | Interpret heat transfer by radiation between objects with simple geometries. |
| CO 5 | Analyze the heat transfer equipment and investigate the performance. |
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| **CO of the Course "Design of Machine Element-I"** | |
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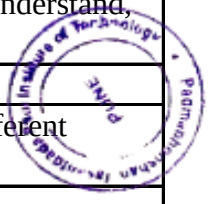
| CO 1 | Ability to analyze the stress-strain, of Machine Elements to understand, identify, quantify the failure modes. |
| CO 2 | Ability to Design Power Screw for Various Applications. |
| CO 3 | Ability to design fasteners and welded joints subjected to different loading conditions. |
| CO 4 | Ability to design various Springs for strength and stiffness. |



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| CO 5 | Select standard data and components by using Design Data Books, Codes and Standards for avoiding failure of machine components. |
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| **CO of the Course "Turbo Machinery"** | |
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| CO1 | Classify turbo machines along with its applications and discuss impulse momentum principle to evaluate performance parameters for flat, inclined plate, curved vane and series of vanes. |
| CO2 | Analyze impulse water turbine with design aspects, selection criteria, performance parameters and characteristics for its use in hydroelectric power plant |
| CO3 | Differentiate reaction water turbines, draft tube types, governing mechanism, with design aspects, selection criteria and determine performance parameters and characteristics |
| CO4 | Discuss steam nozzle, impulse, and reaction steam turbine with governing mechanism, selection criteria, losses and evaluate performance parameters for its use in thermal power plant. |
| CO5 | Classifyrotodynamic, centrifugal pump, heads, cavitation, priming, along with multi staging, system resistance curve and evaluate performance with design aspects and selection criteria for household and industrial application. |
| CO6 | Discuss the construction and working of centrifugal and axial flow compressor with its analysis. |
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| **CO of the Course "Dynamic of Machinery"** | |
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| CO1 | Implement balancing technique to complete balancing of rotating & reciprocating masses in multi cylinder inline & radial engines. |
| CO2 | Express the fundamentals of vibrations and estimate natural frequencies for single DOF un-damped and damped free vibratory systems. |
| CO3 | Formulate analytical competency to judge the response to forced vibrations due to harmonic excitation, base excitation and excitation due to reciprocating and rotary unbalance |
| CO4 | Formulate mathematical model and estimate natural frequencies, mode shapes (Eigen values and Eigen vectors) for DOF undamped free longitudinal and transverse vibratory systems. |
| CO5 | Choose suitable vibration measuring instrument for industrial / real life applications and select suitable method for vibration control |
| CO6 | Interpret noise, its measurement and reduction techniques for industry and day to day life problems |
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| **CO of the Course "CADCAM and Automation"** | |
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| CO1 | Discuss Concept of computer graphics and find the transformations for 2 dimensional elements. |

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| CO2 | Explain Analytically different types of curves, surfaces and solids and modeling the same for 2D/3D conditions. |
| CO3 | Analyze conditional safety of given component using FEA. |
| CO4 | Select CNC machine and develop CNC Part program for given work piece. |
| CO5 | Explain the Rapid Prototyping as advancement in manufacturing and its relation with software's and CAD modeling. |
| CO6 | Explain industrial automation in view of Robotic system, CIM, CAPP. |
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| **CO of the Course "Operation Research"** | |
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| CO1 | Illustrate the need to optimally utilize the resources in various types of industries |
| CO2 | Apply and analyze mathematical optimization functions to various applications |
| CO3 | Demonstrate cost effective strategies in various applications in industry |
| CO4 | Analyze the Dynamic and integer programming and apply them for arriving at optimal decisions |
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| **CO of the Course "Hydraulics and Pneumatics "** | |
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| CO1 | Understand working principle of components used in hydraulic & pneumatic systems |
| CO2 | Identify various applications of hydraulic & pneumatic systems |
| CO3 | Selection of appropriate components required for hydraulic and pneumatic systems |
| CO4 | Analyse hydraulic and pneumatic systems for industrial/mobile applications |
| CO5 | Design a system according to the requirements |
| CO6 | Develop and apply knowledge to various applications |
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| **CO of the Course "Energy Audit and Management"** | |
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| CO1 | Carry out Energy Audit of the residence / society / college where they are studying |
| CO2 | Carry out electrical tariff calculation and accurately predict the electricity bill required for the installation. |
| CO3 | Suggest various methods to reduce energy consumption of the equipment / office / premises |
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| **CO of the Course "Advanced Manufacturing Process"** | |
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| CO 1 | Selection of appropriate manufacturing process for advance components |
| CO 2 | Characterization of work pieces |

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| CO 3 | Selection of appropriate measurement techniques in micromachining |
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| **CO of the Course "Product Design and Development"** | |
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| CO1 | Design a sustainable product. |
| CO2 | Develop commercial Product |
| CO3 | Master in new techniques PLM and PDM |
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| **Department of Mechanical Engineering** | |
| **Semester –II** | |
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| **CO of the Course "Engineering Mathematics - III"** | |
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| CO1 | SOLVE higher order linear differential equations and its applications to model and analyze mass spring systems |
| CO2 | APPLY Integral transform techniques such as Laplace transform and Fourier transform to solve differential equations involved in vibration theory, heat transfer and related mechanical engineering applications |
| CO3 | APPLY Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control. |
| CO4 | PERFORM Vector differentiation & integration, analyze the vector fields and APPLY to fluid flow problems |
| CO5 | SOLVE Partial differential equations such as wave equation, one and two dimensional heat flow equations. |
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| **CO of the Course "Kinematics of Machinery"** | |
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| CO1 | APPLY kinematic analysis to simple mechanisms |
| CO2 | ANALYZE velocity and acceleration in mechanisms by vector and graphical method |
| CO3 | SYNTHESIZE a four bar mechanism with analytical and graphical methods |
| CO4 | APPLY fundamentals of gear theory as a prerequisite for gear design |

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| CO5 | CONSTRUCT cam profile for given follower motion |
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| **CO of the Course "Applied Thermodynamics"** | |
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| CO1 | DETERMINE COP of refrigeration system and ANALYZE psychrometric processes. |
| CO2 | DISCUSS basics of engine terminology,air standard, fuel air and actual cycles. |
| CO3 | IDENTIFY factors affecting the combustion performance of SI and CI engines. |
| CO4 | DETERMINE performance parameters of IC Engines and emission control. |
| CO5 | EXPLAIN working of various IC Engine systems and use of alternative fuels. |
| CO6 | . CALCULATE performance of single and multi stage reciprocating compressors and DISCUSS rotary positive displacement compressors |
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| **CO of the Course "Fluid Mechanics"** | |
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| CO1 | DETERMINE various properties of fluid |
| CO2 | APPLY the laws of fluid statics and concepts of buoyancy |
| CO3 | IDENTIFY types of fluid flow and terms associated in fluid kinematics |
| CO4 | APPLY principles of fluid dynamics to laminar flow |
| CO5 | ESTIMATE friction and minor losses in internal flows and DETERMINE boundary layer formation over an external surface |
| CO6 | CONSTRUCT mathematical correlation considering dimensionless parameters, also ABLE to predict the performance of prototype using model laws |
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| **CO of the Course "Manufacturing Processes"** | |
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| CO1 | SELECT appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and DESIGN riser size and location for sand casting process |
| CO2 | UNDERSTAND mechanism of metal forming techniques and CALCULATE load required for flat rolling |
| CO3 | DEMONSTRATE press working operations and APPLY the basic principles to DESIGN dies and tools for forming and shearing operations |
| CO4 | CLASSIFY and EXPLAIN different welding processes and EVALUATE welding characteristics |

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| CO5 | DIFFERENTIATE thermoplastics and thermosetting and EXPLAIN polymer processing techniques |
| CO6 | UNDERSTAND the principle of manufacturing of fibre-reinforce composites and metal matrix composites |
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| **CO of the Course "Manufacturing Process-II"** | |
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| CO1 | Student should be able to apply the knowledge of various manufacturing processes. |
| CO2 | Student should be able to identify various process parameters and their effect on processes. |
| CO3 | Student should be able to figure out application of modern machining. |
| CO4 | Students should get the knowledge of Jigs and Fixtures for variety of operations |
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| **CO of the Course "Design of Machine Element-II"** | |
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| CO1 | To understand and apply principles of gear design to spur gears and industrial spur gear boxes. |
| CO2 | To become proficient in Design of Helical and Bevel Gear. |
| CO3 | To develop capability to analyze Rolling contact bearing and its selection from manufacturer's Catalogue. |
| CO4 | To learn a skill to design worm gear box for various industrial applications. |
| CO5 | To inculcate an ability to design belt drives and selection of belt, rope and chain drives. |
| CO6 | To achieve an expertise in design of Sliding contact bearing in industrial applications. |
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| **CO of the Course "Refrigeration and Air Conditioning"** | |
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| CO1 | Demonstrate the fundamental Principles of Thermodynamics and working principal of R.A.C. methods |
| CO2 | Analyze the performance of the different Refrigeration cycle using P-h chart & property table & select appropriate for application. |
| CO3 | Select the appropriate refrigerant with respect to properties, application & environmental issues by comparative study. |
| CO4 | Analyze & Design appropriate air-conditioning system for any application |
| CO5 | Illustrate and analyze the principles and working of various equipment & safety controls & select in RAC system |
| CO6 | Demonstrate duct system design methods by solving simple numerical. |
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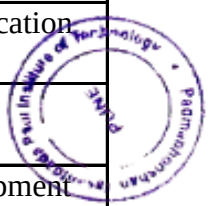

| CO of the Course "Mechatronics" | |
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| CO1 | Identification of key elements of mechatronics system and its representation in terms of block diagram |
| CO2 | Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O |
| CO3 | Interfacing of Sensors, Actuators using appropriate DAQ micro-controller |
| CO4 | Time and Frequency domain analysis of system model (for control application) |
| CO5 | PID control implementation on real time systems |
| CO6 | Development of PLC ladder programming and implementation of real life system. |
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| **CO of the Course "Numerical Methods and Optimization"** | |
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| CO1 | Evaluate the roots of equations and simultaneous equations in engineering applications using iterative approach with minimized error. |
| CO2 | Apply graphical, simplex and Newton's optimization method to solve constrained and unconstrained problems. |
| CO3 | Apply Lagrange's, Newton's forward interpolation method for solving engineering problems, and fit different curves by least square technique. |
| CO4 | Identify significance of numerical integration in engineering problems, and evaluate integration of functions using single and double integration techniques. |
| CO5 | Apply methods encountered in engineering practices to solve ordinary differential equations (ODE) and partial differential equations (PDE). |
| CO6 | Develop programming logic for solving engineering problem using numerical methods. |
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| **CO of the Course "Mechanical System Design"** | |
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| CO1 | The student will understand the difference between component level design and system level design. |
| CO2 | Ability to design various mechanical systems like pressure vessels, machine tool gear boxes, material handling systems, etc. for the specifications stated/formulated. |
| CO3 | Ability to learn optimum design principles and apply it to mechanical components. |
| CO4 | Ability to handle system level projects from concept to product. |
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| **CO of the Course "Power Plant Engineering"** | |
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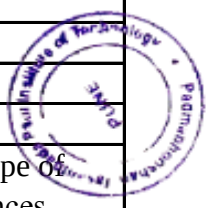
| CO1 | Understand global energy scenario, present status and future scope of power generation in India "estimate various costs and performances incorporated with different types of power generation system". |
| CO2 | Explain and analyze thermal power plant system and cogeneration power plant. |



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| CO3 | Analyze theoretical aspects, geological considerations and different component of hydroelectric and nuclear power plant with economic consideration. |
| CO4 | Elaborate modern and energy intensive power plant with their typical configuration viz. Diesel and gas turbine power plant. |
| CO5 | Illustrate different types of Non-conventional power plant and their commercialization. |
| CO6 | Explain different electrical instruments used in power plant and describe different environment issues, social aspects and global protocol of pollution control caused due to the advent of power plants. |
| | |
| **CO of the Course "Industrial Engineering"** | |
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| CO1 | Describe different aspect of industrial engineering and productivity improvement techniques. |
| CO2 | Apply different concepts of method study to improve the work content |
| CO3 | describe and analyze techniques of work measurement and time study |
| CO4 | Illustrate different aspect of work system design and production planning control |
| CO5 | Identify various cost accounting and financial management practices applicable in different industries |
| CO6 | Apply concept of engineering economy, ergonomics and industrial safety practices. |
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| **CO of the Course "Finite Element Analysis"** | |
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| CO1 | To explain the fundamentals of FEA pertaining to structural and heat transfer domain. |
| CO2 | To formulate and solve 1D element structural problems involving bars, beams, trusses, frames and steady state heat transfer problems. |
| CO3 | To construct and solve 2D element problems involving triangular, quadrilateral, axi-symmetric, Iso-parametric & higher order elements. |
| CO4 | To evaluate appropriate FEA technique to solve dynamic vibrational problems. |
| CO5 | To demonstrate the use of FEA software applied to solve structural and heat transfer problems. |
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| **Department of Civil Engineering** | |
| **Semester –I** | |
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| **CO of the Course "Building Technology and Architectural Planning** | |
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| CO1 | Identify types of building and basic requirements of building components. |
| CO2 | Make use of Architectural Principles and Building byelaws for building construction. |

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| CO3 | Plan effectively various types of Residential Building forms according to their utility, functions with reference to National Building Code |
| CO4 | Plan effectively various types of Public Buildings according to their utility functions with reference to National Building Code. |
| CO5 | Make use of Principles of Planning in Town Planning, Different Villages and Safety aspects. |
| CO6 | Understand different services and safety aspects |
| | |
| **CO of the Course "Mechanics of Structures** | |
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| CO1 | Understand concept of stress-strain and determine different types of stress, strain in determinate, indeterminate homogeneous and composite structures |
| CO2 | Calculate shear force and bending moment in determinate beams for different loading conditions and illustrate shear force and bending moment diagram. |
| CO3 | Explain the concept of shear and bending stresses in beams and demonstrate shear and bending stress distribution diagram. |
| CO4 | Use theory of torsion to determine the stresses in circular shaft and understand concept of Principal stresses and strains. |
| CO5 | Analyze axially loaded and eccentrically loaded column. |
| CO6 | Determine the slopes and deflection of determinate beams and trusses. |
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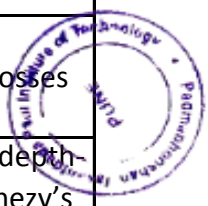
| **CO of the Course "Fluid Mechanics"** | |
| | |
| CO1 | Understand the use of Fluid Properties, concept of Fluid statics, basic equation of Hydrostatics, measurement of fluid pressure, buoyancy & floatation and its application for solving practical problems. |
| CO2 | Understand the concept of fluid kinematics with reference to Continuity equation and fluid dynamics with reference to Modified Bernoulli's equation and its application to practical problems of fluid flow |
| CO3 | Understand the concept of Dimensional analysis using Buckingham's π theorem, Similarity & Model Laws and boundary layer theory and apply it for solving practical problems of fluid flow. |
| CO4 | Understand the concept of laminar and turbulent flow and flow through pipes and its application to determine major and minor losses and analyze pipe network using Hardy Cross method. |
| CO5 | Understand the concept of open channel flow, uniform flow and depth-Energy relationships in open channel flow and make the use of Chezy's and Manning's formulae for uniform flow computation and design of most economical channel section |



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| CO6 | Understand the concept of gradually varied flow in open channel and fluid flow around submerged objects, compute GVF profile and calculate drag and lift force on fully submerged body. |
| | |
| **CO of the Course "Engineering Mathematics III"** | |
| | |
| CO1 | Solve Higher order linear differential equations and its applications to modelling and analysing Civil engineering problems such as bending of beams, whirling of shafts and mass spring systems. |
| CO2 | Solve System of linear equations using direct & iterative numerical techniques and develop solutions for ordinary differential equations using single step & multistep methods applied to hydraulics, geotechnics and structural systems. |
| CO3 | Apply Statistical methods like correlation, regression and probability theory in data analysis and predictions in civil engineering |
| CO4 | Perform Vector differentiation &integration, analyze the vector fields and apply to fluid flow problems. |
| CO5 | Solve Partial differential equations such as wave equation, one and two dimensional heat flow equations. C |
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| **CO of the Course "Engineering Geology"** | |
| | |
| CO1 | Explain about the basic concepts of engineering geology, various rocks, and minerals both in lab and on the fields and their inherent characteristics and their uses in civil engineering constructions. |
| CO2 | Exploring the importance of mass wasting processes and various tectonic processes that hampers the design of civil engineering projects and its implications on environment and sustainability. |
| CO3 | Recognize effect of plate tectonics, structural geology and their significance and utility in civil engineering activities. |
| CO4 | Incorporate the various methods of survey, to evaluate and interpret geological nature of the rocks present at the foundations of the dams, percolation tanks, tunnels and to infer site / alignment/ level free from geological defects. |
| CO5 | Assess the Importance of geological nature of the site, precautions and treatments to improve the site conditions for dams, reservoirs, and tunnels. |
| CO6 | Explain geological hazards and importance of ground water and uses of common building stones. |
| | |
| **CO of the Course "Hydrology and water resource engineering"** | |
| | |
| CO1 | Able to describe the hydrologic cycle and analyze the precipitation data. |
| CO2 | Able to explain the stream gauging. |
| CO3 | Able to explain the methods of irrigation and assess the canal revenue. |
| CO4 | Able to describe the ground water hydrology. |

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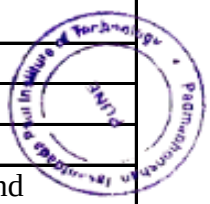
| CO5 | Able to analyze the flood frequency and runoff hydrograph. |
| CO6 | Able to characterize the various terms related to reservoir planning. |
| CO7 | Able to explain the lift irrigation schemes and process of water logging. |
| | |
| **CO of the Course "Infrastructure Engineering and Construction** | |
| | |
| CO1 | Identify role of infrastructure engineering in national and global development. |
| CO2 | Explain the different elements of Railways. |
| CO3 | Elucidate different types of construction techniques. |
| CO4 | Illustrate different types of tunneling methods. |
| CO5 | Explain the importance of docks and harbors. |
| CO6 | Describe different types of Earth moving equipments. |
| | |
| **CO of the Course "Structural Design-I"** | |
| | |
| CO1 | Able to explain various philosophy, classify structural steel section, analyze and design of tension member. |
| CO2 | Able to analyze and design compression members along with design of base. |
| CO3 | Able to find flexural strength of steel beams and to design the beams for give loading. |
| CO4 | Able to analyze the loads and their effects on connection and plate girder and design of the plate. |
| CO5 | Able to analyze the loads and their effects on gantry girder and design of the gantry girder. |
| CO6 | Able to design an industrial steel building using I.S. 800:2007 |
| | |
| **CO of the Course "Structural Analysis-II"** | |
| | |
| CO1 | Able to explain the basics of configuration, classification and fundamental concepts of structural analysis. |
| CO2 | Able to determine slope and deflection of beams, frames and trusses by applying appropriate method. |
| CO3 | Able to analyse inderminate structure using energy methods, compatibility method. |
| CO4 | Able to draw Influence line diagram for determinate beams, trusses and applications of ILD |
| CO5 | Able to analyse arches for external and internal forces. |
| CO6 | Able to identify plastic behavior of material and perform plastic analysis of indeterminate beams and frames |
| | |
| **CO of the Course "Fluid Mechanics II"** | |
| | |
| CO1 | Able to analyze the basics of flow around submerged bodies, and fundamental concepts of unsteady flow in Fluid Mechanics. |
| CO2 | Able to analyze the basics of flow around submerged bodies, and fundamental concepts of unsteady flow in Fluid Mechanics. |



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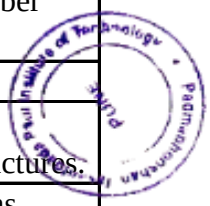
| CO3 | Able to explain types of flow based on energy depth relationship. |
| CO4 | Able to analyze uniform flow formula and characteristics of hydraulic jump with applications to civil engineering problems. |
| CO5 | Able to explain the impact of jets and working of centrifugal pump. |
| CO6 | Able to explain components of hydropower plants and performance of hydraulic turbines. |
| CO7 | Able to differentiate the GVF profile and its computations in open channel. |
| | |
| **CO of the Course "Environmental Engineering II "** | |
| | |
| CO1 | Able to explain sources, collection, effects, measurements of sewage and storm water and stream self cleaning system. |
| CO2 | Able to explain component of wastewater treatment plant units. |
| CO3 | Able to describe and design unit operation and unit process in wastewater treatment plant and design activated sludge process and trickling filter. |
| CO4 | Able to describe and design low cost treatment methods like oxidation pond, aerated lagoons. |
| CO5 | Able to describe onsite wastewater treatments methods, and anaerobic digester. |
| CO6 | Able to describe industrial wastewater treatment methods. |
| CO7 | Able to draft reports concerned with testing of Wastewater samples and design of various components of wastewater treatment plant including use of software's. |
| | |
| **CO of the Course "Transportation Engineering "** | |
| | |
| CO1 | To discuss historical development, classification and planning of roads in India. |
| CO2 | To understand basic requirements and mechanisms for highway maintenance, drainage, economic, and environment. |
| CO3 | To perform analysis and design of flexible and rigid pavements. |
| CO4 | Understand the various components of airports, planning concepts and air traffic controls. |
| CO5 | Understand the various terms in bridge engineering and its classification. |
| | |
| **CO of the Course "Structural Design and Drawing III "** | |
| | |
| CO1 | Able to describe various systems of prestressing and analyze member strength. |
| CO2 | Able to design Prestressed member for flexure and shear. |
| CO3 | Able to do load calculations and load transfer Phenomenon of structures. |
| CO4 | Able to analyze the frame structure for different load Combinations. |
| CO5 | Able to design and detailing of floor beam in a frame. |



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| CO6 | Able to design and detailing of different elements of special structures like retaining walls, liquid retaining structures, combined footings and their behavior under load. |
| | |
| **CO of the Course "Architecture and Town Planning"** | |
| | |
| CO1 | Able to understand the principles, elements and qualities of architecture. |
| CO2 | Able to study objectives , principles of landscaping and sustainable architecture. |
| CO3 | Able to understand necessity of town planning, principles of planning, principles of Architecture and byelaws. |
| CO4 | Able to study development plan, neighborhood plan & Intelligent transport system. |
| CO5 | Able to understand legislative mechanism for preparation of DP and MRTP. |
| CO6 | Able to understand the concept of special township,GIS,GPS with respect to planning. |
| | |
| **CO of the Course "TQM & MIS in Civil Engineering"** | |
| | |
| CO1 | Able to explain the various definition of quality and its interpretations, important of quality in construction. |
| CO2 | Able to explain concept of Quality Manual and Total Quality Management. |
| CO3 | Able to identify Supply chain management and bench marking process. |
| CO4 | Able to explain Management Information Systems (MIS) and decision support system. |
| CO5 | Able o explain Management information system structure based on management and various types of planning. |
| CO6 | Able to explain Concepts of information, planning and control, information based system. |
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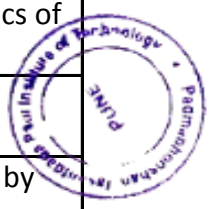
| **Department of Civil Engineering** | |
| **Semester –II** | |
| | |
| **CO of the Course "Geotechnical Engineering"** | |
| | |
| CO1 | Identify and classify the soil based on the index properties and its formation process |
| CO2 | Explain permeability and seepage analysis of soil by construction of flow net. |
| CO3 | Illustrate the effect of compaction on soil and understand the basics of stress distribution. |
| CO4 | Express shear strength of soil and its measurement under various drainage conditions. |
| CO5 | Evaluate the earth pressure due to backfill on retaining structures by using different theories |
| CO6 | Analysis of stability of slopes for different types of soils. |



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| **CO of the Course "Surveying"** | |
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| CO1 | Define and Explain basics of plane surveying and differentiate the instruments used for it. |
| CO2 | Express proficiency in handling surveying equipment and analyse the surveying data from these equipment. |
| CO3 | Describe different methods of surveying and find relative positions of points on the surface of earth |
| CO4 | Execute curve setting for civil engineering projects such as roads, railways etc. |
| CO5 | Articulate advancements in surveying such as space based positioning systems |
| CO6 | Differentiate map and aerial photographs, also interpret aerial photographs |
| | |
| **CO of the Course " Concrete Technology"** | |
| | |
| CO1 | Able to select the various ingredients of concrete and its suitable proportion to achieved desired strength. |
| CO2 | Able to check the properties of concrete in fresh and hardened state. |
| CO3 | Get acquainted to concreting equipments, techniques and different types of special concrete. |
| CO4 | Able to predict deteriorations in concrete and get acquainted to various repairing methods and techniques. |
| | |
| **CO of the Course "Structural Analysis"** | |
| | |
| CO1 | Understand the basic concept of static and kinematic indeterminacy and analysis of indeterminate beams |
| CO2 | Analyze redundant trusses and able to perform approximate analysis of multi-story multi-bay frames. |
| CO3 | Implement application of the slope deflection method to beams and portal frames |
| CO4 | Analyze beams and portal frames using moment distribution method. |
| CO5 | Determine response of beams and portal frames using structure approach of stiffness matrix method. |
| CO6 | Apply the concepts of plastic analysis in the analysis of steel structures. |
| | |
| **CO of the Course "Project Management "** | |
| | |
| CO1 | Describe project life cycle and the domains of Project Management. |
| CO2 | Explain networking methods and their applications in planning and management |

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| CO3 | Categorize the materials as per their annual usage and also Calculate production rate of construction equipment |
| CO4 | Demonstrates resource allocation techniques and apply it for manpower planning. |
| CO5 | Understand economical terms and different laws associated with project management |
| CO6 | Apply the methods of project selection and recommend the best economical project |
| | |
| **CO of the Course "Advanced Surveying"** | |
| | |
| CO 1 | Able to carry out field geodetic survey and apply triangulation adjustment with modern equipment's |
| CO 2 | Able to perform Geodetic trigonometric leveling |
| CO 3 | Able to perform hydrographic survey and get solution for problems related to it |
| CO 4 | Able to describe aerial photography and applications in civil engineering |
| CO 5 | Able to explain Remote sensing and GIS and its application in civil engineering field |
| | |
| **CO of the Course " Project Management and Engineering Economics"** | |
| | |
| CO 1 | Able to explain the importance, objective, and functions of project management |
| CO 2 | Able to analyze the network for planning and scheduling of project |
| CO 3 | Able to apply project monitoring, resource allocation using project management software's |
| CO 4 | Able to apply a engineering economics in construction industry. |
| CO 5 | Able to apply concept of material management and implement safety norms |
| CO 6 | Able to evaluate project appraisal and prepare project feasibility report and Detailed Project report |
| | |
| **CO of the Course "Structural Design II"** | |
| | |
| CO1 | Able to distinguish different design philosophies of design of R.C structures and analyze the limitations and advantages of each |
| CO2 | Able to apply different limit states for singly and doubly reinforced, balanced beam section and to design one way slabs |
| CO3 | Able to design two way slabs and staircases |
| CO4 | Able to design flexural members. |
| CO5 | Able to design flexural members for shear, bond, torsion and design continuous beam with concept of redistribution of moments |
| CO6 | Discuss the construction and working of centrifugal and axial flow compressor with its analysis. |
| | |
| **CO of the Course "Environmental Engineering I"** | |
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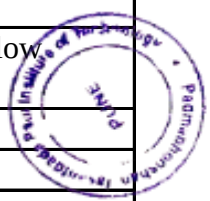

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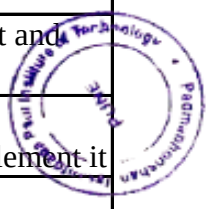
| CO1 | Able to describe sources and effects of noise and air pollution, evaluate its quality as per BIS |
| CO2 | Able to identify a suitable water intake structure, describe water supply scheme and define water demand for a community |
| CO3 | Able to design Aeration and Sedimentation processes with due importance to quality of water as per BIS |
| CO4 | Able to design Coagulation, Flocculation and Filtration processes used for raw water treatment |
| CO5 | Able to describe disinfection, water softening methods, demineralization, adsorption along with fluoridation and defluoridation techniques |
| CO6 | Able to describe Rain water harvesting, packaged Water treatment plant and determine the capacity of ESR. |
| | |
| **CO of the Course "Foundation Engineering "** | |
| | |
| CO1 | Able to execute soil exploration |
| CO2 | Ability to calculate bearing capacity of all type of foundations with respect to soil conditions |
| CO3 | Proficient to analyze consolidation and time rate settlements and able to recognize basic consolidation theory |
| CO4 | Able to classify piles and their uses, and calculate the load carrying capacity |
| CO5 | Able to describe sheet piles and problems associated with BC soil |
| CO6 | Able to evaluate liquefaction potential and explain Geosynthetics and its application |
| | |
| **CO of the Course " Dams and Hydraulics Structures"** | |
| | |
| CO1 | Able to analyze and ,design gravity dam ,earthen dam and check its stability |
| CO2 | Able to explain generalized information regarding dams |
| CO3 | Able to design hydraulic structures |
| CO4 | Able to explain river training methods and design of guide bund |
| CO5 | Able to explain hydropower engineering with respect to its components and functions |
| | |
| **CO of the Course "Quantity Surveying, Contracts and Tenders"** | |
| | |
| CO1 | Able to describe types of estimates and importance of approximate estimate |
| CO2 | Able prepare detailed estimate for Civil Engineering Structures |
| CO3 | Able to draft suitable specifications to meet expectations of client and prepare the rate analysis |
| CO4 | Able to choose suitable method of valuation of property and implement it |
| CO5 | Able to explain execution of works in PWD and tendering. |
| CO6 | Able to illustrate meaning, validity, the conditions and laws of contract |
| | |



| CO of the Course" Construction Management" | |
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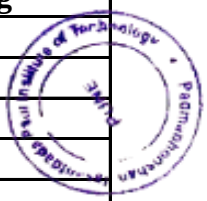
| | |
| CO1 | Able to explain the basics construction management |
| CO2 | Able to implement construction scheduling and illustrate work study and its measurement |
| CO3 | Able to describe labor laws and financial aspects of construction projects |
| CO4 | Able to identify and analyze the risks involved in projects and perform value analysis. |
| CO5 | Able to explain material and human resource management in construction |
| CO6 | Able to explain basic terminologies and applications of artificial intelligence in civil engineering |
| | |
| **CO of the Course "Advanced Transportation Engineering"** | |
| | |
| CO1 | To understand transportation planning and analysis, evaluating transportation alternatives and public transport system. |
| CO2 | To understand concepts of traffic engineering including traffic control, control aids, regulations, highway capacity, and design of intersections |
| CO3 | To understand fundamentals of pavement design and perform design of rigid and flexible pavements using various methods |
| CO4 | To know various road specifications and procedure for mix design |
| CO5 | To understand overlay design and construction |
| CO6 | To understand various construction methods for soil stabilized roads |
| | |
| **CO of the Course "Hydropower Engineering"** | |
| | |
| CO1 | Able to explain various energy resources and analyze hydropower potential |
| CO2 | Able to design components of hydro power plants |
| CO3 | Able to explain various types of turbines and design them |
| CO4 | Able to determine electrical terms and regulations related to hydro power |
| | |
| **Department of Electronics and Telecommunication Engineering** | |
| **Semester –I** | |
| | |
| **CO of the Course "Engineering Mathematics III "** | |
| | |
| CO1 | Solve higher order linear differential equation using appropriate techniques for modelling, analyzing of electrical circuits and control systems. |
| CO2 | Apply concept of Fourier transform & Z-transform and its applications to continuous & discrete systems, signal & image processing and communication systems |



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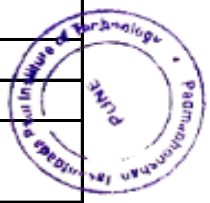
| CO3 | Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing |
| CO4 | Perform vector differentiation & integration, analyze the vector fields and apply to electro- magnetic fields & wave theory. |
| CO5 | Analyze Complex functions, Conformal mappings, Contour integration applicable to electrostatics, digital filters, signal and image processing |
| | |
| **CO of the Course "Electronics Circuits"** | |
| | |
| CO1 | Assimilate the physics, characteristics and parameters of MOSFET towards its application as amplifier. |
| CO2 | Design MOSFET amplifiers, with and without feedback, & MOSFET oscillators, for given specifications. |
| CO3 | Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies. |
| CO4 | Explain internal schematic of Op-Amp and define its performance parameters. |
| CO5 | Design, Build and test Op-amp based analog signal processing and conditioning circuits towards various real time applications. |
| CO6 | Understand and compare the principles of various data conversion techniques and PLL with their applications. C |
| | |
| **CO of the Course "Digital Circuits** | |
| | |
| CO1 | Identify and prevent various hazards and timing problems in a digital design |
| CO2 | Use the basic logic gates and various reduction techniques of digital logic circuit. |
| CO3 | Analyze, design and implement combinational logic circuits. |
| CO4 | Analyze, design and implement sequential circuits. |
| CO5 | Differentiate between Mealy and Moore machines |
| CO6 | Analyze digital system design using PLD. |
| | |
| **CO of the Course "Electrical Circuits "** | |
| | |
| CO1 | Analyze the simple DC and AC circuit with circuit simplification techniques |
| CO2 | Formulate and analyze driven and source free RL and RC circuits |
| CO3 | Formulate & determine network parameters for given network and analyze the given network using Laplace Transform to find the network transfer function. |
| CO4 | Explain construction, working and applications of DC Machines / Single Phase & Three Phase AC Motors. |



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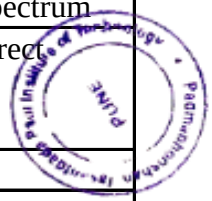
| CO5 | Explain construction, working and applications of special purpose motors & understand motors used in electrical vehicles. |
| CO6 | Analyze and select a suitable motor for different applications |
| | |
| **CO of the Course "Data Structures"** | |
| | |
| CO1 | Solve mathematical problems using C programming language. |
| CO2 | Implement sorting and searching algorithms and calculate their complexity |
| CO3 | Develop applications of stack and queue using array. |
| CO4 | Demonstrate applicability of Linked List. |
| CO5 | Demonstrate applicability of nonlinear data structures - Binary Tree with respect to its time complexity. |
| CO6 | Apply the knowledge of graph for solving the problems of spanning tree and shortest path algorithm |
| | |
| **CO of the Course "Microcontrollers"** | |
| | |
| CO 1 | Recall the basic concepts of microcontroller. Understand architecture, features and instructions of typical 8 bit microcontroller Intel 8051. |
| CO 2 | Apply knowledge of microcontrollers to interface and program simple devices.Understand the application of software and hardware tools. |
| CO 3 | Adapt the concepts of microcontroller to design and develop real world application |
| CO4 | Learn the architecture and features of PIC microcontroller |
| CO5 | Apply knowledge of embedded c programming, interfacing devices and make use of these concepts to develop real world applications. |
| CO6 | Apply knowledge of embedded c programming, interfacing devices and make use of various communication protocols to interface real world devices. |
| | |
| **CO of the Course "Digital Communication"** | |
| | |
| CO 1 | Understand working of waveform coding techniques and analyze their performance. |
| CO 2 | Discriminate & select line code in terms of B W. & bit rate and able to apply concept of synchronization , scrambler & ISI in application |
| CO 3 | Discriminate different random processes and apply its knowledge for designing digital communication system. |
| CO 4 | Describe coherent detection and evaluate error performance of a digital receiver in presence of noise and other interferences. |
| CO 5 | Design & analyze different coherent & non coherent pass band transmission system in terms of probability of error & power spectrum |
| CO6 | Describe the concept of spread spectrum techniques & apply direct sequence spread spectrum & frequency hop spread spectrum in communication system |
| | |
| **CO of the Course "Digital Signal Processing"** | |



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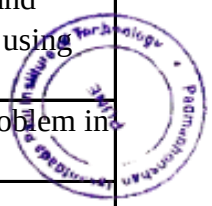
| | |
| CO 1 | Understand analysis and processing of digital signal |
| CO 2 | Understand the fast computation of DFT and appreciate the FFT processing |
| CO 3 | Perform time, frequency and Z -transform analysis on signals and systems. |
| CO 4 | Design a digital filter for a given specification of analog filter with warping effect and finite length word effects |
| CO 5 | Design the digital filter from given specification of digital filter using significance of various filter structures |
| CO 6 | Understand the real-world signal processing applications. |
| | |
| **CO of the Course "Electromagnetics"** | |
| | |
| CO1 | Apply and understand the basic mathematical concepts related to electromagnetic vector fields. |
| CO2 | To understand principles of electrostatics to the solutions of problems relating to dielectrics, electric field, boundary conditions and electric energy density. |
| CO3 | Apply principles of magnetostatics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density. |
| CO4 | To understand the concepts related to Faraday's law and Maxwell's equations. |
| CO5 | Analyze the transmission line problem, use smith chart for impedance matching |
| CO6 | Discuss the construction and working of centrifugal and axial flow compressor with its analysis. |
| | |
| **CO of the Course "Mechatronics"** | |
| | |
| CO1 | Identification of key elements of mechatronics system and its representation in terms of block diagram. |
| CO2 | Understanding basic principal of Sensors and Transducer. |
| CO3 | Understand concept of actuator |
| CO4 | Able to prepare case study of the system given. |
| | |
| **CO of the Course "VLSI Design& Technology "** | |
| | |
| CO1 | Apply Basic knowledge of digital electronics to construct and demonstrate digital system design modules using VHDL coding. |
| CO2 | Recognizing the development of the custom IC using EDA tool and Identify the implementation of reconfigurable computing system using FPGA/CPLD. |
| CO3 | Explain and identify clock distribution and power distribution problem in chip design.Interconnect issues with chip interfacing. |
| CO4 | Design CMOS circuits for specific digital applications. |



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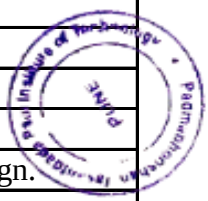
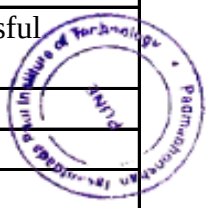
| CO5 | Apply knowledge to design Analog CMOS structures to compute area , power and speed.This can be recognizing in mixed signal logic. |
| CO6 | Experiment timing issues to avail certain function execution. To demonstrate different types of testing in IC design and exploring the testing results with standard platform. |
| | |
| **CO of the Course "Radiation & Microwave Techniques "** | |
| | |
| CO1 | Differentiate various performance parameters of radiating elements. |
| CO2 | Analyze various radiating elements and arrays |
| CO3 | Apply the knowledge of waveguide fundamentals in design of transmission lines. |
| CO4 | Design and set up a system consisting of various passive microwave components. |
| CO5 | Analyze tube based and solid state active devices along with their applications. |
| CO6 | Measure various performance parameters of microwave components. |
| | |
| **CO of the Course "Internet of Things "** | |
| | |
| CO1 | Understand the various concepts, terminologies and architecture of IoT systems. |
| CO2 | Use sensors and actuators for design of IoT. |
| CO3 | Understand and apply various protocols for design of IoT systems |
| CO4 | Use various techniques of data storage and analytics in IoT |
| CO5 | Understand various applications of IoT |
| | |
| **CO of the Course "Computer Networks & Security"** | |
| | |
| CO1 | Understand fundamental underlying principles of computer networking |
| CO2 | Describe and analyze the hardware, software, components of a network and their interrelations. |
| CO3 | Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies |
| CO4 | Have a basic knowledge of installing and configuring networking applications |
| CO5 | Specify and identify deficiencies in existing protocols, and then go onto select new and better protocols. |
| CO6 | Have a basic knowledge of the use of cryptography and network security. |
| | |
| **CO of the Course "Electronics Product Design"** | |
| | |
| CO 1 | Understand various stages of hardware, software and PCB design. |
| CO 2 | Importance of product test & test specifications. |



| | |
|---|---|
| CO 3 | Special design considerations and importance of documentation |
| | |
| **Department of Electronics and Telecommunication Engineering** | |
| **Semester –II** | |
| | |
| **CO of the Course " Signals & Systems** | |
| | |
| CO1 | Identify, classify basic signals and perform operations on signals. |
| CO2 | Identify, Classify the systems based on their properties in terms of input output relation and in terms of impulse response and will be able to determine the convolution between to signals. |
| CO3 | Analyze and resolve the signals in frequency domain using Fourier series and Fourier Transform. |
| CO4 | Resolve the signals in complex frequency domain using Laplace Transform, and will be able to apply and analyze the LTI systems using Laplace Transforms. |
| CO5 | Define and Describe the probability, random variables and random signals. Compute the probability of a given event, model, compute the CDF and PDF. |
| CO6 | Compute the mean, mean square, variance and standard deviation for given random variables using PDF |
| | |
| **CO of the Course " Control Systems"** | |
| | |
| CO1 | Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems. |
| CO2 | Determine the (absolute) stability of a closed-loop control system |
| CO3 | Perform time domain analysis of control systems required for stability analysis. |
| CO4 | Perform frequency domain analysis of control systems required for stability analysis. |
| CO5 | Apply root-locus, Frequency Plots technique to analyze control systems |
| CO6 | Express and solve system equations in state variable form |
| CO7 | Differentiate between various digital controllers and understand the role of the controllers in Industrial automation |
| | |
| **CO of the Course "Principles of Communication Systems"** | |
| | |
| CO1 | To compute & compare the bandwidth and transmission power requirements by analyzing time and frequency domain spectra of signal required for modulation schemes under study. |
| CO2 | Describe and analyze the techniques of generation, transmission and reception of Amplitude Modulation Systems. |
| CO3 | Explain generation and detection of FM systems and compare with AM systems |
| CO4 | Exhibit the importance of Sampling Theorem and correlate with Pulse Modulation technique (PAM, PWM, and PPM). |

| | |
|---|---|
| CO5 | Characterize the quantization process and elaborate digital representation techniques (PCM, DPCM, DM and ADM). |
| CO6 | Illustrate waveform coding, multiplexing and synchronization techniques and articulate their importance in baseband digital transmission. |
| | |
| **CO of the Course "Object Oriented Programming"** | |
| | |
| CO1 | Describe the principles of object oriented programming |
| CO2 | Apply the concepts of data encapsulation, inheritance in C++ |
| CO3 | Understand Operator overloading and friend functions in C++ |
| CO4 | Apply the concepts of classes, methods inheritance and polymorphism to write programs C++ |
| CO5 | Apply Templates, Namespaces and Exception Handling concepts to write programs in C++. |
| CO6 | Describe and use of File handling in C++. |
| | |
| **CO of the Course "Advanced Processor "** | |
| | |
| CO 1 | Describe the ARM microprocessor architectures and its feature. |
| CO 2 | Interface the advanced peripherals to ARM based microcontroller |
| CO 3 | Design embedded system with available resources. |
| CO 4 | Use of DSP Processors and resources for signal processing applications |
| | |
| **CO of the Course "System Programming and Operating System"** | |
| | |
| CO 1 | Demonstrate the knowledge of Systems Programming and Operating Systems |
| CO 2 | Formulate the Problem and develop the solution for same. |
| CO 3 | Compare and analyze the different implementation approach of system programming operating system abstractions. |
| CO 4 | Interpret various OS functions used in Linux / Ubuntu. |
| | |
| **CO of the Course "Business Management"** | |
| | |
| CO 1 | Describe fundamentals of Management thoughts, vital for understanding the conceptual frame work of Management as a discipline. |
| CO 2 | Understand quality assessment tools for project development including analysis of impact of finance factors. |
| CO 3 | Recognize the development, impact of manpower on internal and external environment to promote entrepreneurship. |
| CO 4 | Know about modern ways of managing information for successful business. |
| | |
| **CO of the Course "Power Electronics"** | |
| | |
| CO1 | Identify & analyze different power devices used in power Electronics . |
| CO2 | Design & implement a triggering / gate drive circuit for a power device |



| | |
|---|---|
| CO3 | Understand, perform & analyze different controlled converters. |
| CO4 | Working & analysis of controlled rectifiers for different loads |
| CO5 | Design & implement over voltage / over current protection circuit. |
| CO6 | Discuss the construction and working of centrifugal and axial flow compressor with its analysis. |
| | |
| **CO of the Course " Information Theory and Coding "** | |
| | |
| CO1 | Infer source coding theorem, employ source coding techniques in data compression and evaluate entropy, loss of information in channel. |
| CO2 | Define channel capacity, identify error correcting and detecting capabilities and perform error correction using different block codes. |
| CO3 | Describe Galois field and related basics, explain and evaluate cyclic codes and design encoder-decoder circuit. |
| CO4 | Design multiple error correcting codes such as, BCH and RS, explain error control coding techniques and Construct Convolutional codes. |
| CO5 | Understand and apply fundamental principles of data communication and networking. |
| CO6 | Describe and analyze the hardware, software, components of a network and the interrelations. Apply flow and error control techniques in communication networks. |
| | |
| **CO of the Course "Mobile communication"** | |
| | |
| CO1 | Apply the concepts of switching technique and traffic engineering to design multistage networks |
| CO2 | Explore the architecture of GSM. |
| CO3 | Differentiate thoroughly the generations of mobile technologies. |
| | |
| **CO of the Course "Broadband Communication Systems"** | |
| | |
| CO1 | Perform Link power budget and Rise Time Budget by proper selection of components and check its viability. |
| CO2 | Perform Satellite Link design for Up Link and Down Link. |
| | |
| **CO of the Course "Machine Learning"** | |
| | |
| CO1 | To compare and contrast pros and cons of various machine learning techniques and to get an in sight of when to apply a particular machine learning approach. |
| CO2 | To mathematically analyze various machine learning approaches and paradigms. |
| CO3 | To implement convolution neural networks in recognition applications. |
| | |
| **CO of the Course "Wireless Sensor Networks"** | |
| | |
| CO1 | Explain various concepts and terminologies used in WSN |

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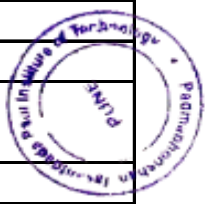
|---|---|
| CO2 | Describe importance and use of radio communication and link management in WSN |
| CO3 | Explain various wireless standards and protocols associated with WSN |
| CO4 | Recognize importance of localization and routing techniques used in WSN |
| CO5 | Understand techniques of data aggregation and importance of security in WSN |
| CO6 | Examine the issues involved in design and deployment of WSN |
| | |
| **Department of Computer Engineering** | |
| **Semester –I** | |
| | |
| **CO of the Course "Discrete Mathematics"** | |
| | |
| CO1 | Design and analyze real world engineering problems by applying set theory, propositional logic and mathematical induction |
| CO2 | Develop skill in expressing mathematical properties of relation and function |
| CO3 | Identify number of logical possibilities of events to design professional engineering Solutions |
| CO4 | Model and solve computing problem using tree and graph Analyze the properties of binary operations and evaluate the algebraic structure |
| CO5 | Apply abstract algebra in combinatorics, coding theory and questions regarding geometric constructions C |
| | |
| **CO of the Course " Fundamentals of Data Structures** | |
| | |
| CO1 | To demonstrate a detailed understanding of behaviour of data structures like array, linked list, stack, and queue by developing programs. |
| CO2 | To use appropriate algorithmic strategy for better efficiency |
| CO3 | To summarize data searching and sorting techniques. |
| CO4 | To discriminate the usage of various structures in approaching the problem solution. |
| CO5 | To analyze and use effective and efficient data structures in solving various Computer Engineering domain problems. |
| CO6 | To design the algorithms to solve the programming problems. |
| | |
| **CO of the Course " Object Oriented Programming"** | |
| | |
| CO1 | Analyze the strengths of object oriented programming |
| CO2 | Design and apply OOP principles for effective programming |
| CO3 | Develop the application using object oriented programming language(C++) |
| CO4 | Apply object-oriented concepts for advanced programming. |
| | |



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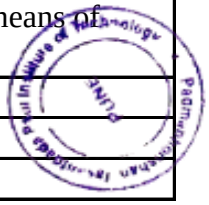
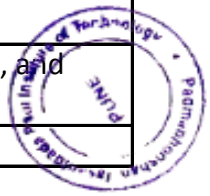
| | |
| **CO of the Course "Computer Graphics"** | |
| | |
| CO1 | Define basic terminologies of Computer Graphics, interpret the mathematical foundation of the concepts of computer graphics and apply mathematics to develop Computer programs for elementary graphic operations. |
| CO2 | Define the concept of windowing and clipping and apply various algorithms to fill and clip polygons. |
| CO3 | Explain the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection. |
| CO4 | Explain the concepts of color models, lighting, shading models and hidden surface elimination. |
| CO5 | Describe the fundamentals of curves, fractals, animation and gaming. |
| | |
| **CO of the Course "Digital Electronics and Logic Design"** | |
| | |
| CO1 | Simplify Boolean Expressions using K Map. |
| CO2 | Design and implement combinational circuits. |
| CO3 | Design and implement sequential circuits. |
| CO4 | Develop simple real-world application using ASM and PLD. |
| CO5 | Choose appropriate logic families IC packages as per the given design specifications. |
| CO6 | Explain organization and architecture of computer system |
| | |
| **CO of the Course "Theory of Computation"** | |
| | |
| CO1 | Design, manipulate, and reason about formal computational models, such as automata and Turing machines |
| CO2 | Identify relations between classes of computational problems, formal languages, and computational models |
| CO3 | Apply mathematical knowledge and logic in solving problems |
| CO4 | Illustrate various Turing machine and related hypotheses |
| CO5 | Analyze deeper and broader concepts of grammar, parsing and push down automata. |
| CO6 | Apply NP-completeness concepts to create proofs regarding the computational complexity of novel problems |
| | |
| **CO of the Course "Database Management Systems"** | |
| | |
| CO1 | Identify structure of database system using data models and design E-R Model for given requirements and convert the same into database tables. |
| CO2 | Describe database techniques such as SQL & PL/SQL. |
| CO3 | Discuss relational model and database design. |
| CO4 | Explain transaction Management in relational database System. |

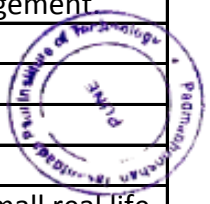
| | |
|---|---|
| CO5 | Describe different database architecture and analyses the use of appropriate architecture in real time environment. |
| CO6 | Use advanced database Programming concepts Big Data – HADOOP |
| | |
| **CO of the Course "Software Engineering and Project Management"** | |
| | |
| CO1 | Decide on a process model for a developing a software project |
| CO2 | Classify software applications and Identify unique features of various domains |
| CO3 | Design test cases of a software system. |
| CO4 | Understand basics of IT Project management. |
| CO5 | Plan, schedule and execute a project considering the risk management. |
| CO6 | Apply quality attributes in software development life cycle. |
| | |
| **CO of the Course "Information Systems & Engineering Economics"** | |
| | |
| CO1 | Understand the need, usage and importance of an Information System to an organization. |
| CO2 | Understand the activities that are undertaken while managing, designing, planning, implementation, and deployment of computerized information system in an organization. |
| CO3 | Further the student would be aware of various Information System solutions like ERP, CRM, Data warehouses and the issues in successful implementation of these technology solutions in any organizations |
| CO4 | Outline the past history, present position and expected performance of a company engaged in engineering practice or in the computer industry. |
| CO5 | Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. |
| CO6 | Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives. |
| | |
| **CO of the Course "Computer Network"** | |
| | |
| CO1 | Analyze the requirements for a given organizational structure to select the most appropriate networking architecture, topologies, transmission mediums, and technologies |
| CO2 | Demonstrate design issues, flow control and error control |
| CO3 | Illustrate applications of Computer Network capabilities, selection and usage for various sectors of user community. |
| CO4 | Demonstrate different routing and switching algorithms |
| CO5 | Analyze data flow between TCP/IP model using Application, Transport and Network Layer Protocols. |
| CO6 | Illustrate Client-Server architectures and prototypes by the means of correct standards and technology. |
| | |
| **CO of the Course "High Performance Computing"** | |
| | |



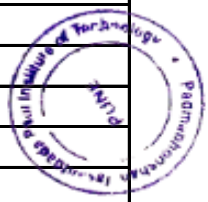
| | |
|---|---|
| CO1 | Describe different parallel architectures, inter-connect networks, programming models |
| CO2 | Develop an efficient parallel algorithm to solve given problem |
| CO4 | Analyze and measure performance of modern parallel computing systems |
| CO5 | Build the logic to parallelize the programming task |
| | |
| **CO of the Course "Artificial Intelligence and Robotics"** | |
| | |
| CO1 | Identify and apply suitable Intelligent agents for various AI applications |
| CO2 | Design smart system using different informed search / uninformed search or heuristic approaches. |
| CO3 | Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem |
| CO4 | Apply the suitable algorithms to solve AI problems |
| | |
| **CO of the Course "Data Analytics"** | |
| | |
| CO1 | Write case studies in Business Analytic and Intelligence using mathematical models |
| CO2 | Present a survey on applications for Business Analytic and Intelligence |
| CO3 | Provide problem solutions for multi-core or distributed, concurrent/Parallel environments |
| | |
| **CO of the Course "Elective-I: Data Mining and Warehousing"** | |
| | |
| CO1 | Apply basic, intermediate and advanced techniques to mine the data |
| CO2 | Analyze the output generated by the process of data mining |
| CO3 | Explore the hidden patterns in the data |
| CO4 | Optimize the mining process by choosing best data mining technique |
| | |
| **CO of the Course "Elective-II: Software Testing and Quality Assurance"** | |
| | |
| CO1 | Describe fundamental concepts in software testing such as manual testing, automation testing and software quality assurance. |
| CO2 | Design and develop project test plan, design test cases, test data, and conduct test operations |
| CO3 | Apply recent automation tool for various software testing for testing software |
| CO4 | Apply different approaches of quality management, assurance, and quality standard to software system |
| CO5 | Apply and analyze effectiveness Software Quality Tools |
| | |



| Department of Computer Engineering | |
|---|---|
| **Semester –II** | |
| | |
| | |
| CO1 | Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits. |
| CO2 | Solve problems related to Fourier transform, Z-Transform and applications to Signal and Image processing. |
| CO3 | Apply statistical methods like correlation, regression analysis and probability theory for analysis and prediction of a given data as applied to machine intelligence |
| CO4 | Perform vector differentiation and integration to analyze the vector fields and apply to compute line, surface and volume integrals. |
| CO5 | Analyze conformal mappings, transformations and perform contour integration of complex functions required in Image processing, Digital filters and Computer graphics. |
| | |
| **CO of the Course "Data Structures & Algorithms"** | |
| | |
| CO1 | To identify & articulate the complexity goals and benefits of a good hashing scheme for realworld applications. |
| CO2 | To apply non-linear data structures for solving problems of various domain. |
| CO3 | To design and specify the operations of a nonlinear-based abstract data type and implement them in a high-level programming language. |
| CO4 | To analyze the algorithmic solutions for resource requirements and optimization |
| CO5 | :To use efficient indexing methods and multiway search techniques to store and maintain data |
| CO6 | To use appropriate modern tools to understand and analyze the functionalities confined to the secondary storage. C |
| | |
| **CO of the Course "Software Engineering"** | |
| | |
| CO1 | Apply software engineering principles to develop software |
| CO2 | Analyze software requirements and formulate design solution for a software |
| CO3 | Explain concepts of project estimation, planning and scheduling. |
| CO4 | Explain risk management and software configuration management |
| CO5 | Explain various types of software testing. |
| | |
| **CO of the Course "Microprocessor"** | |
| | |
| CO1 | To apply the assembly language programming to develop small real life embedded application. |



| | |
|---|---|
| CO2 | To understand the architecture of the advanced processor thoroughly to use the resources for programming |
| CO3 | To understand the higher processor architectures descended from 80386 architecture |
| | |
| **CO of the Course "Principles of Programming Languages"** | |
| CO1 | Make use of basic principles of programming languages |
| CO2 | Able to develop a program with Data representation and Computations |
| CO3 | Able to develop programs using Object Oriented Programming language : Java |
| CO4 | Develop application using inheritance, encapsulation, and polymorphism |
| CO5 | Able to demonstrate Applet and Multithreading for robust application development |
| CO6 | Able to develop a simple program using basic concepts of Functional and Logical programming paradigm |
| | |
| **CO of the Course "Design & Analysis of Algorithms"** | |
| | |
| CO1 | Understand the fundamentals of algorithm designs. |
| CO2 | Solve a problem using an algorithm and evaluate its correctness |
| CO3 | Describe, apply and analyze the complexity of certain divide and conquer, greedy, and dynamic programming, backtracking and branch and bound algorithm techniques to solve problems |
| CO4 | Develop Understand the concepts of time and space complexity, worst case, average case and best case complexities |
| CO5 | Analyze the asymptotic performance of algorithms. |
| CO6 | Describe the classes P, NP, and NP-Complete and be able to prove that a certain problem is NP-Complete. |
| CO7 | Understand analysis techniques such as amortized analysis, probabilistic analysis, randomness and Minimax or Maximin optimality. |
| CO8 | Identify and analyze criteria and specifications appropriate to new problems, and choose the appropriate algorithmic design technique for their solution. |
| | |
| **CO of the Course "Systems Programming & Operating System"** | |
| | |
| CO1 | Analyze and synthesize of assembler |
| CO2 | Analyze and synthesize macro Processor |
| CO3 | Use tools like LEX & YACC. |
| CO4 | Implement operating system functions |
| CO5 | Implement memory management functions of OS. |
| CO6 | Implement I/O management functions of OS. |
| | |
| **CO of the Course "Embedded Systems & Internet of Things"** | |
| | |
| CO1 | Understand the basic concepts of Embedded System and IOT |



| | |
|---|---|
| CO2 | Choose different design methodologies for embedded IoT |
| CO3 | Implement an architectural design for IoT for specified requirements |
| CO4 | Classify various IoT protocols and different security models. |
| CO5 | Compare Web of Things and Cloud of Things |
| CO6 | Choose between available technologies and devices for stated IoT challenge |
| | |
| **CO of the Course "Software Modeling and Design "** | |
| | |
| CO1 | To analyze the problem statement (SRS) and choose proper design technique for designing web-based or desktop application |
| CO2 | To design and analyze an application using UML modeling as fundamental tool. |
| CO3 | To apply design patterns to understand reusability in OO design |
| CO4 | To decide and apply appropriate modern tool for designing and modeling. |
| CO5 | To decide and apply appropriate modern testing tool for testing web-based or desktop application. |
| | |
| **CO of the Course "Web Technology"** | |
| | |
| CO1 | To understand web and technologies that makes the web pages. |
| CO2 | To understand the use of JavaScript and jQuery |
| CO3 | To learn the Installation of Tomcat Server and execution of programs on server side. |
| CO4 | Analyze given assignment to select sustainable web development design methodology |
| CO5 | Develop web based application using suitable client side and server-side web technologies |
| CO6 | Develop solution to complex problems using appropriate method, technologies, frameworks, web services and content management. |
| | |
| | |
| **CO of the Course "Machine Learning"** | |
| | |
| CO1 | Distinguish different learning based applications |
| CO2 | Apply different preprocessing methods to prepare training data set for machine learning. |
| CO3 | Design and implement supervised and unsupervised machine learning algorithm |
| CO4 | Implement different learning models |
| CO5 | Learn Meta classifiers and deep learning concepts |
| | |
| **CO of the Course "Information and Cyber Security"** | |
| | |
| CO1 | Gauge the security protections and limitations provided by today's technology. |
| CO2 | Identify information security and cyber security threats |

| | |
|---|---|
| CO4 | Analyze given assignment to select sustainable web development design methodology |
| CO5 | Develop web based application using suitable client side and server-side web technologies |
| CO6 | Develop solution to complex problems using appropriate method, technologies, frameworks, web services and content management. |
| | |
| | |
| **CO of the Course "Machine Learning"** | |
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| CO4 | Implement different learning models |
| CO5 | Learn Meta classifiers and deep learning concepts |
| | |
| **CO of the Course "Information and Cyber Security"** | |
| | |
| CO1 | Gauge the security protections and limitations provided by today's technology. |
| CO2 | Identify information security and cyber security threats |
| CO3 | Analyze threats in order to protect or defend it in cyberspace from cyber-attacks. |
| CO4 | Build appropriate security solutions against cyber-attacks. |
| | |
| **CO of the Course "Embedded and Real Time Operating Systems"** | |
| | |
| CO1 | Recognize and classify embedded and real-time systems |
| CO2 | Explain communication bus protocols used for embedded and real-time systems |
| CO3 | Classify and exemplify scheduling algorithms |
| CO4 | Apply software development process to a given RTOS application |
| CO5 | Design a given RTOS based application |
| | |
| **CO of the Course "Cloud Computing"** | |
| | |
| CO1 | To install cloud computing environments. |
| CO2 | To develop any one type of cloud |
| CO3 | To explore future trends of cloud computing |

PRINCIPAL
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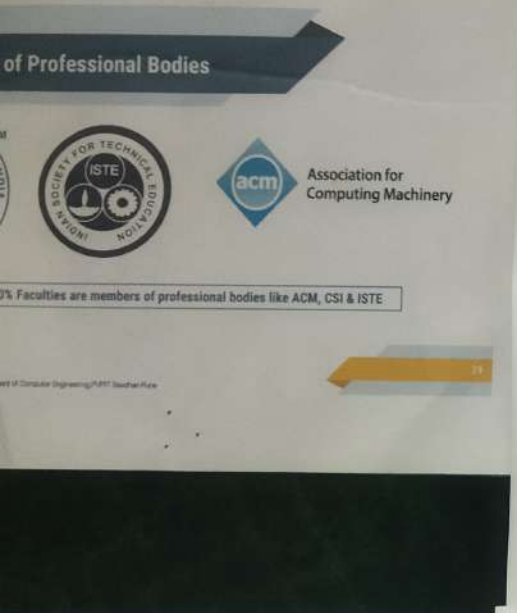




**Padmabhooshan Vasantdada Patil Institute of Technology**

**Bavdhan,Pune-21 (Maharashtra)**

**DEPARTMENT OF COMPUTER ENGINEERING**

## Course Objective and Outcome

| | |
|---|---|
| **Class** | Third Year Computer Engineering |
| **Course** | Theory of Computation |
| **Course Code** | 310241 |
| **Academic Year** | 2020-21 |
| **Semester** | 5 |
| **Name of Course Co-ordinator** | Prof. Snehal R. Javheri |

**Course Objective:**

1. To learn formal Programming Language Theory
2. To learn Grammar and Turing Machine Designing

**Course Outcomes:**

**CO1**: Ability to design, manipulate and reason about formal computational models, such as automata and Turing machines.

**CO2**: Ability to identify relations between classes of computational problems, formal languages and computational models.

**CO3**: Ability to apply mathematical knowledge and logic in solving problems

**CO4**: Ability to illustrate various Turing machine and related hypotheses.

**CO5**: Ability to analyze deeper and broader concepts of grammar, parsing and push down automata.

**CO6**: Ability to apply NP-completeness concepts to create proofs regarding the computational complexity of novel problems.

**Combined CO**:

After completing this course, students will be able to:

Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.

**Program outcomes addressed by the Course :**

| PO | Description |
|---|---|
| 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 addressed by the Course :**

| PSO | | Description |
|---|---|---|
| PSO1 | a | **Computer/Operating System:** Understand the basic components of a computer, including CPU, memories, and input/output, design and their organization. |
| | b | Ability to understand the principles, administration and working of operating systems. |
| PSO2 | a | **Networking :** Develop solutions for networking and security problems. |
| PSO3 | a | **Software development:** Possess knowledge of software design process. |
| | b | Ability to understand the structure and development methodologies of software systems. |
| | c | Practical competence with a broad range of programming language and open source platforms. |
| PSO4 | a | **Database:** Provide and implement a database solutions to an information technology problem. |
| PSO5 | a | **Computing:** Ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable algorithm. |
| PSO6 | a | Communication |

**Relevance of CO with PO**

| CO | PO addressed | Level of mapping (3,2,1) | Justification of mapped level |
|---|---|---|---|
| CO301.1 | PO1 | 2 | Knowledge of automata complexity and computability. |
| | PO2 | 1 | Define and analyze the computational problem. |
| | PO3 | 1 | Design a FA |
| | PO12 | 2 | Future scope in various computational problem. |
| CO301.2 | PO1 | 1 | Knowledge of finite automata |
| | PO2 | 2 | Define and analyze the interconversion of FA. |
| | PO3 | 1 | Design a DFA and NFA |
| | PO12 | 1 | Future scope in various computational problem. |
| CO301.3 | PO1 | 1 | Knowledge of computing |
| | PO2 | 2 | Define and analyze the CFG. |
| | PO3 | 1 | Design a CFG |
| | PO12 | 2 | Future scope in various compiler designing. |
| CO301.4 | PO1 | 2 | Knowledge of mathematics |
| | PO3 | 1 | Design a TM |
| | PO12 | 1 | Future scope in arithmetical computation. |
| CO301.5 | PO1 | 1 | Knowledge of mathematics |
| | PO2 | 1 | Define and analyze the PDA |
| | PO3 | 1 | Design a PDA |
| | PO12 | 1 | Future scope in stack manipulation |
| CO301.6 | PO1 | 1 | Knowledge of solvable and unsolvable problems |
| | PO2 | 2 | Define and analyze undecidable problem |
| | PO3 | 1 | Design a undecidable problem |
| | PO12 | 1 | Future scope in various undecidable problems. |
| Combined CO | PO2 | 2 | Analyze FA,PDA, TM,grammar etc. |
| | PO3 | 2 | Design of FA,PDA,TM etc. |
| | PO12 | 1 | Future scope in various computational problem. |

**Relevance of CO with PSO**

| CO | PSO addressed | Level of mapping (3,2,1) | Justification of mapped level |
|---|---|---|---|
| CO301.1 | PSO3a | 1 | Knowledge of automata and Turing machine |
| CO301.2 | PSO3a | 2 | Analyzing computational model to solve computation task |
| CO301.3 | PSO3a | 3 | Apply mathematical knowledge to solve computation task |
| CO301.4 | PSO3a | 1 | Knowledge of Turing machines |
| CO301.5 | PSO3a | 1 | Knowledge of Grammar and PDA |
| CO301.6 | PSO3a | 2 | Finding computation complexity of complex problems |
| Combined CO301 | PSO3a | 1 | Finding computation complexity of complex problems |

mputer Engineering)

(A & B)

Padmabhooshan Vasantdada Patil Institute of Technology

Bavdhan,Pune-21 (Maharashtra)

DEPARTMENT OF COMPUTER ENGINEERING

## Course Objective and Outcome

| | |
|---|---|
| **Class** | Third Year Computer Engineering |
| **Course** | Theory of Computation |
| **Course Code** | 310241 |
| **Academic Year** | 2020-21 |
| **Semester** | 5 |
| **Name of Course Co-ordinator** | Prof. Snehal R. Javheri |

**Course Objective:**

1. To learn formal Programming Language Theory
2. To learn Grammar and Turing Machine Designing

**Course Outcomes:**

**CO1**. Ability to design, manipulate and reason about formal computational models, such as automata and Turing machines.

**CO2**. Ability to identify relations between classes of computational problems, formal languages and computational models.

**CO3**. Ability to apply mathematical knowledge and logic in solving problems

**CO4**. Ability to illustrate various Turing machine and related hypotheses.

**CO5**. Ability to analyze deeper and broader concepts of grammar, parsing and push down automata.

**CO6**. Ability to apply NP-completeness concepts to create proofs regarding the computational complexity of novel problems.

**Combined CO**

After completing this course, students will be able to

Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.

**Program outcomes addressed by the Course :**

| PO | Description |
|---|---|
| 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 addressed by the Course :**

| PSO | | Description |
|---|---|---|
| PSO1 | a | **Computer/Operating System:** Understand the basic components of a computer, including CPU, memories, and input/output, design and their organization. |
| | b | Ability to understand the principles, administration and working of operating systems. |
| PSO2 | a | **Networking :** Develop solutions for networking and security problems. |
| PSO3 | a | **Software development:** Possess knowledge of software design process. |
| | b | Ability to understand the structure and development methodologies of software systems. |
| | c | Practical competence with a broad range of programming language and open source platforms. |
| PSO4 | a | **Database:** Provide and implement a database solutions to an information technology problem. |
| PSO5 | a | **Computing:** Ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable algorithm. |
| PSO6 | a | Communication |

**Relevance of CO with PO**

| CO | PO addressed | Level of mapping (3,2,1) | Justification of mapped level |
|---|---|---|---|
| CO301.1 | PO1 | 2 | Knowledge of automata complexity and computability. |
| | PO2 | 1 | Define and analyze the computational problem. |
| | PO3 | 1 | Design a FA |
| | PO12 | 2 | Future scope in various computational problem |
| CO301.2 | PO1 | 1 | Knowledge of finite automata |
| | PO2 | 2 | Define and analyze the interconversion of FA |
| | PO3 | 1 | Design a DFA and NFA |
| | PO12 | 3 | Future scope in various computational problem |
| CO301.3 | PO1 | 1 | Knowledge of computing |
| | PO2 | 2 | Define and analyze the CFG |
| | PO3 | 1 | Design a CFG |
| | PO12 | 2 | Future scope in various compiler designing |
| CO301.4 | PO1 | 2 | Knowledge of mathematics |
| | PO3 | 1 | Design a TM |
| | PO12 | 1 | Future scope in arithmetical computation |
| CO301.5 | PO1 | 1 | Knowledge of mathematics |
| | PO2 | 1 | Define and analyze the PDA |
| | PO3 | 1 | Design a PDA |
| | PO12 | 1 | Future scope in stack manipulation |
| CO301.6 | PO1 | 1 | Knowledge of solvable and unsolvable problems |
| | PO2 | 2 | Define and analyze undecidable problem |
| | PO3 | 1 | Design a undecidable problem |
| | PO12 | 1 | Future scope in various undecidable problems |
| Combined CO | PO2 | 3 | Analyze FA, PDA, TM, grammar etc. |
| | PO3 | 3 | Design of FA, PDA, TM etc. |
| | PO12 | 1 | Future scope in various computational problem |

**Relevance of CO with PSO**

| CO | PSO addressed | Level of mapping (3,2,1) | Justification of mapped level |
|---|---|---|---|
| CO301.1 | PSO5a | 1 | Knowledge of automata and Turing machine |
| CO301.2 | PSO5a | 2 | Analyzing computational model to solve computation task |
| CO301.3 | PSO5a | 3 | Apply mathematical knowledge to solve computation task |
| CO301.4 | PSO5a | 1 | Knowledge of Turing machines |
| CO301.5 | PSO5a | 1 | Knowledge of Grammar and PDA |
| CO301.6 | PSO5a | 2 | Finding computation complexity of complex problem |
| Combined CO301 | PSO5a | 1 | Finding computation complexity of complex problem |

The Shetkari Shikshan Mandal's

# Padmabhooshan Vasantdada Patil Institute of Technology, Bavdhan, Pune.

## PROGRAMME OUTCOME

**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 modelling 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 principle and commit 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 multi disciplinary 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 the set 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 life-long learning in the broadest context of technological change.

The Shetkari Shikshan Mandal's

# Padmabhooshan Vasantdada Patil Institute of Technology, Bavdhan, Pune

## DEPARTMENT OF COMPUTER ENGINEERING

**Course Code: 210251 Course Title: Computer Graphics**

### Course Objectives

1. To acquaint the learner with the basic concepts of Computer Graphics.
2. To learn the various algorithms for generating and rendering graphical figures.
3. To get familiar with mathematics behind the graphical transformations.
4. To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting

### Course Outcomes

**At the end of course students will be able to :**

**CO1:** Apply mathematics and logic to utilize basic concept of computer graphics to apply scan conversion algorithm in various engineering and commercial application.

**CO2:** Implement polygon filling, windowing, clipping algorithm and interpret graphical transformations.

**CO3:** Apply to 2D and 3D transformation on various graphical object.

**CO4:** Illustrate the concept of related to computer vision and virtual reality using interactive graphics and animation.

**CO5:** Able to apply color shading effect to identify for detecting and removing the hidden line and hidden surface.

**CO6:** To summarize and demonstrate advanced animation and gaming techniques by using modern graphics tools

### Prerequisite

- Data Structures and algorithms.
- Basic Mathematics, Geometry, linear algebra, vectors and matrices.

### Relevance with PO's

| | | | |
|---|---|---|---|
| **K** Applying Knowledge | **A** Problem Analysis | **D** Design & Development | **I** Investigation of problems |
| **M** Modern Tool Usage | **E** Engineer & Society | **E** Environment Sustainability | **T** Ethics |
| **T** Individual & Team work | **O** Communi-cation | **M** Project Management & Finance | **I** Life Long Learning |

### Core Contents - (Key Concepts)

Pixel

Vector graphics

Shading

Computer animation

Pixel art

3D modeling

### Recent Development

Animating Believable Animal

Autodesk 3ds Max

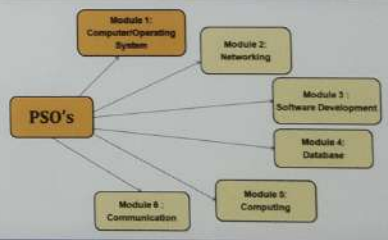
Google Sketch Up

Fully integrated MRI

### Scope of Course (Future Prospects)

| Emerging technology | Potential applications |
|---|---|
| Computer-generated imagery | Films, photos, computer games |
| Immersive virtual reality | An artificial environment where the user feels just as immersed as they usually feel in consensus reality. |
| Ultra-high-definition television | High-definition television |
| 3D displays | Autostereoscopic display, stereoscopic display, volumetric display, Holographic display, Light Field display, Nintendo 3DS, HTC Evo 3D |

### Relevance with Module (PSO)




### Job Opportunities

**Career in Computer Graphics**

- Layout Artist
- Brand Identity Design
- Logo Designer
- Flash Designer
- Photoshop Artist
- Multimedia Designer
- Web Designer

**Industries work on Computer Graphics**

- SIGGRAPH
- GDC
- Bell Telephone Laboratories
- United States Armed Forces
- Boeing
- IBM
- Renault
- Autodesk
- Adobe Systems
- Pixar
- Silicon Graphics, Khronos Group & OpenGL
- The DirectX division at Microsoft
- Nvidia
- AMD

## Program Educational Objectives (PEO)

- PEO1: Have abilities for successful professional career.
- PEO2: Have an ability to address real life problem using modern tools and techniques.
- PEO3: Have an ability to build enterprise for betterment of society ethically.

## Program Specific Outcomes (PSO)

- **Computer/Operating System:** Understand the basic components of a computer, including CPU, memories, and input/output, design and their organization.
  Ability to understand the principles , administration and working of Operating systems
- **Networking: :** Develop solutions for networking and security problems.
- **Software development: :** Ability to understand the structure and development methodologies of software systems. Possess knowledge of software design process. .
  Practical competence with a broad range of programming language and open source platforms.
- **Database: :** Provide and implement database solutions to an information technology problem.
- **Computing: :** Ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable algorithm.
- **Communication (Verbal or Written) :**

## Activities

Co-Curricular Activities

Extra-Curricular Activities

## Latest News

skilled 2019-05-01 First Price in Roll Ball State ...

skilled 2019-05-01 Congratulations to jayesh kamb ...

- **Communication (Verbal or Written) :**

## Program Outcomes (PO)

- Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- Ethics: Apply ethical principle and commit professional ethics and responsibilities and norms of the engineering practice.
- Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 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.
- Project management and finance: Demonstrate knowledge and understanding of the engineering and

# Program Outcomes (PO)

- **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, to model and analyse electronic systems.
- **Problem Analysis:** Demonstrate the ability to identify, formulate, analyse and solve engineering problems.
- **Design/Development of Solutions:** Demonstrate the ability to design a system components, or processes that meet specified needs with appropriate consideration for public health and safety.
- **Conduct Investigations of Complex Problems:** Demonstrate the ability to design experiments, test electronic circuits and analyse and interpret data.
- **Modern Tool Usage:** Able to use modern engineering techniques, skills, and computing tools necessary for engineering practice.
- **The Engineer and Society:** Demonstrate to understand the impact of engineering solutions using contemporary technology in a global and societal, health, safety, legal issues.
- **Environment and Sustainability:** Able to work professionally in electronics and telecommunication domain including the design and realization of such system to address social and environmental needs for sustainable development.
- **Ethics:** Demonstrate the understanding of professional and ethical responsibility.
- **Individual and Team Work:** Demonstrate the ability to function as an individual, team member or leader in inter-disciplinary settings.
- **Communication:** Demonstrate the ability to communicate effectively with written, oral and visual means.
- **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to manage projects.
- **Life-long Learning:** Recognize the need for, and have preparation and ability to engage in independent life-long learning in the context of technological change.

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## Program Specific Outcomes (PSO)
## Mechanical Engineering

At the end of this program, students will develop

**PSO1:** An ability to design solutions for thermal, hydraulic systems, design components and production processes that meet the specified needs with team work and management skills for safety, societal and environmental aspects through lifelong learning

**PSO2**: An ability to use modelling and analysis software such as NX, Creo, CATIA, ANSYS etc. technologies necessary for obtaining quick, economical and accurate solutions of engineering problems.

**PSO3:** An ability to design electromechanical and automation systems in multidisciplinary environments through better communication.

## Program Specific Outcomes (PSO)
## Civil Engineering

At the end of this program, students will develop

**PSO1:** Conceptualise projects related to different field of civil engineering, collect relevant data by direct and indirect methods, analyse the projects requirement & design the projects.

**PSO2:** Select materials, prepare estimates/costing, schedule work plans.

**PSO3:** Apply knowledge of different field of civil engineering, conduct experiments, analyze, interpret data & design he system components.

**PSO4:** Understand basic professional practice concepts and importance of licensure.

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## Program Specific Outcomes (PSO)

## Electronics & Telecommunication Engineering

At the end of this program, students will develop

**PSO1:** Demonstrate reasonable amount of proficiency in the areas of digital communication, embedded systems and project development.

**PSO2:** Utilize modern tools to analyze the performance of communication systems.

## Program Specific Outcomes (PSO)

## Computer Engineering

At the end of this program, students will develop

**PSO1 Computer/Operating System:** Understand the basic components of a computer, including CPU, memories, and input/output, design and their organization. Ability to understand the principles , administration and working of Operating systems.

**PSO2 Networking :** Develop solutions for networking and security problems.

**PSO3 Software development :** Ability to understand the structure and development methodologies of software systems. Possess knowledge of software design process. Practical competence with a broad range of programming language and open source platforms.

**PSO4 Database :** Provide and implement database solutions to an information technology problem.

**PSO5 Computing :** Ability to apply mathematical methodologies to solve computation task, model real world problem using appropriate data structure and suitable algorithm.

**PSO6 Communication (Verbal or Written)**

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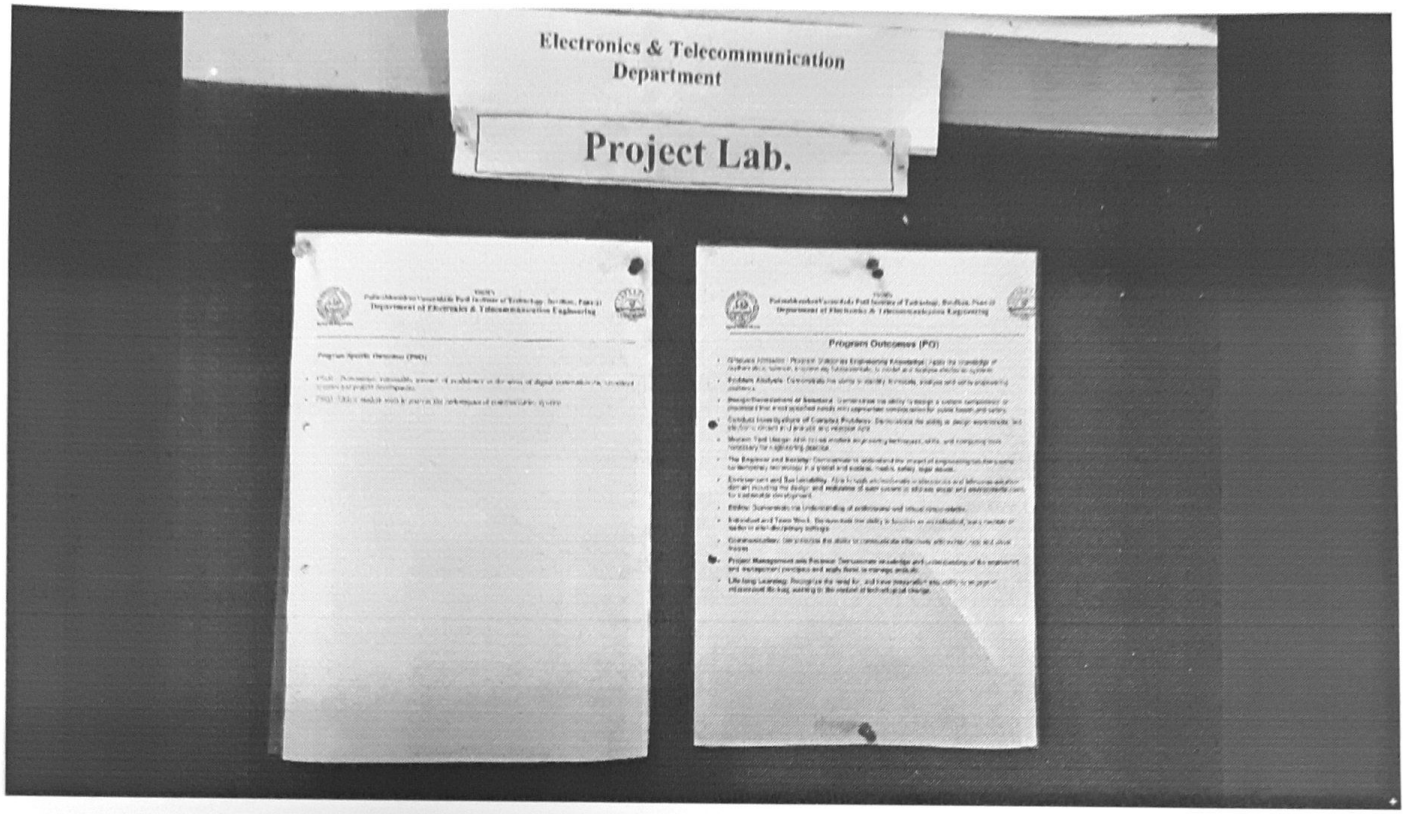
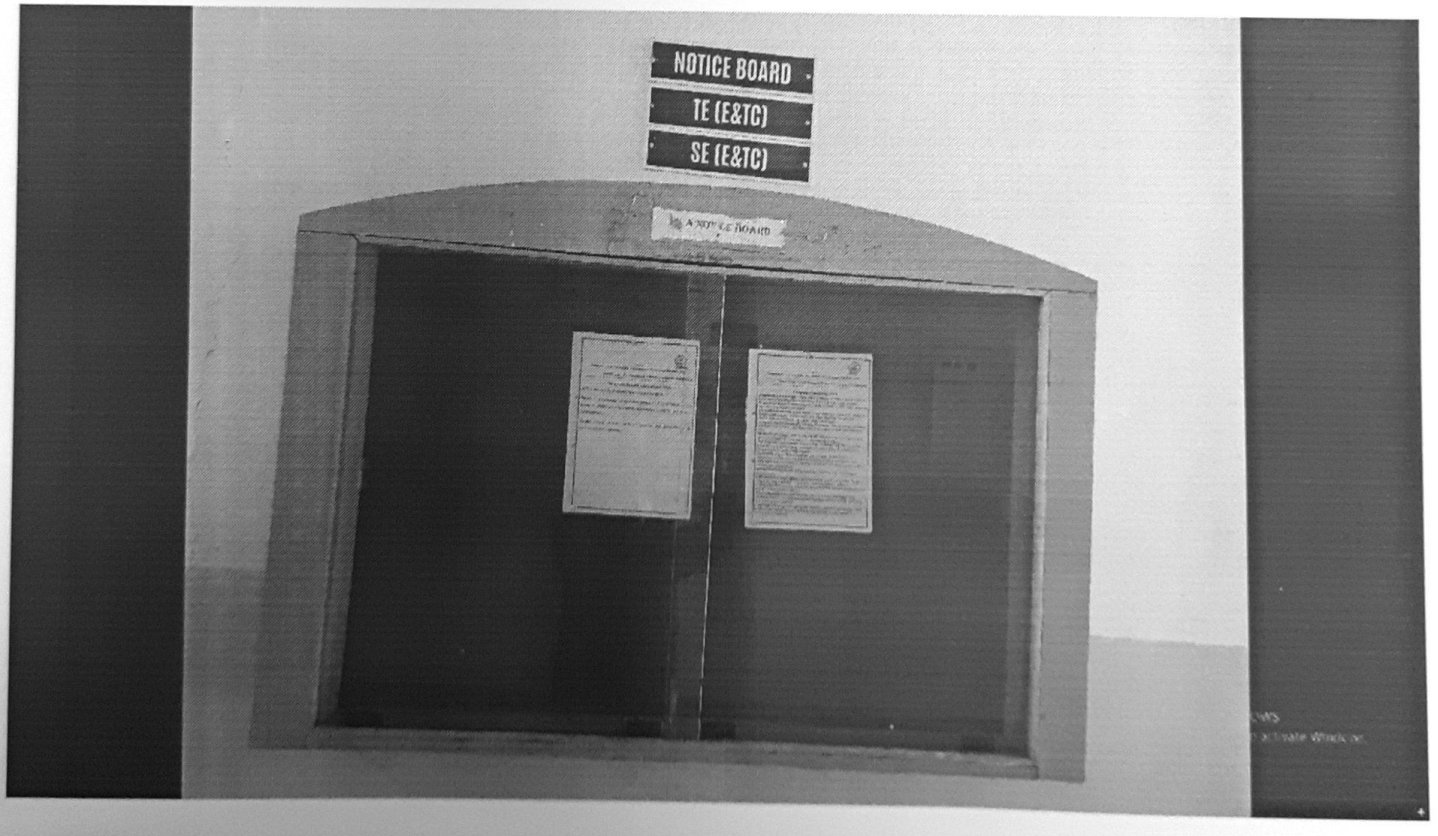
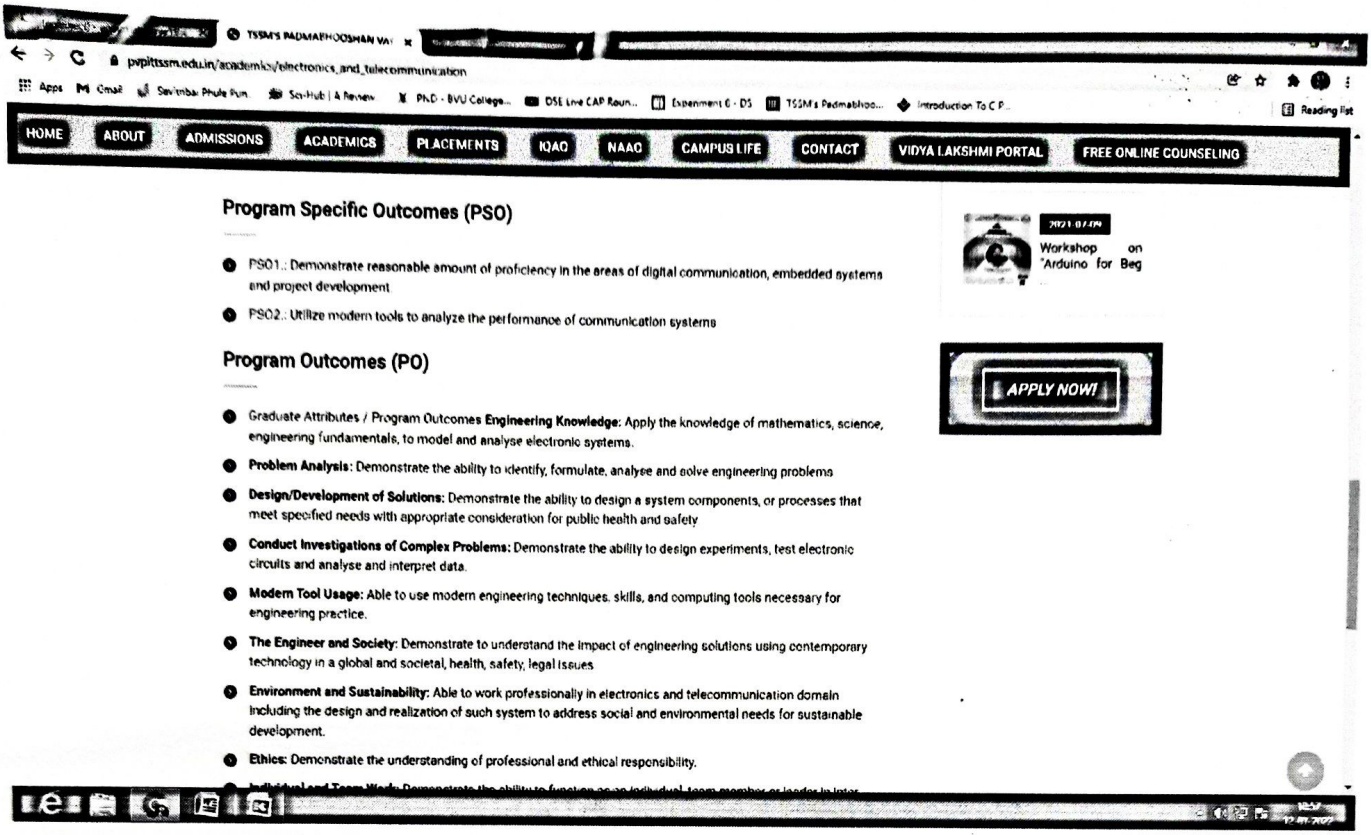


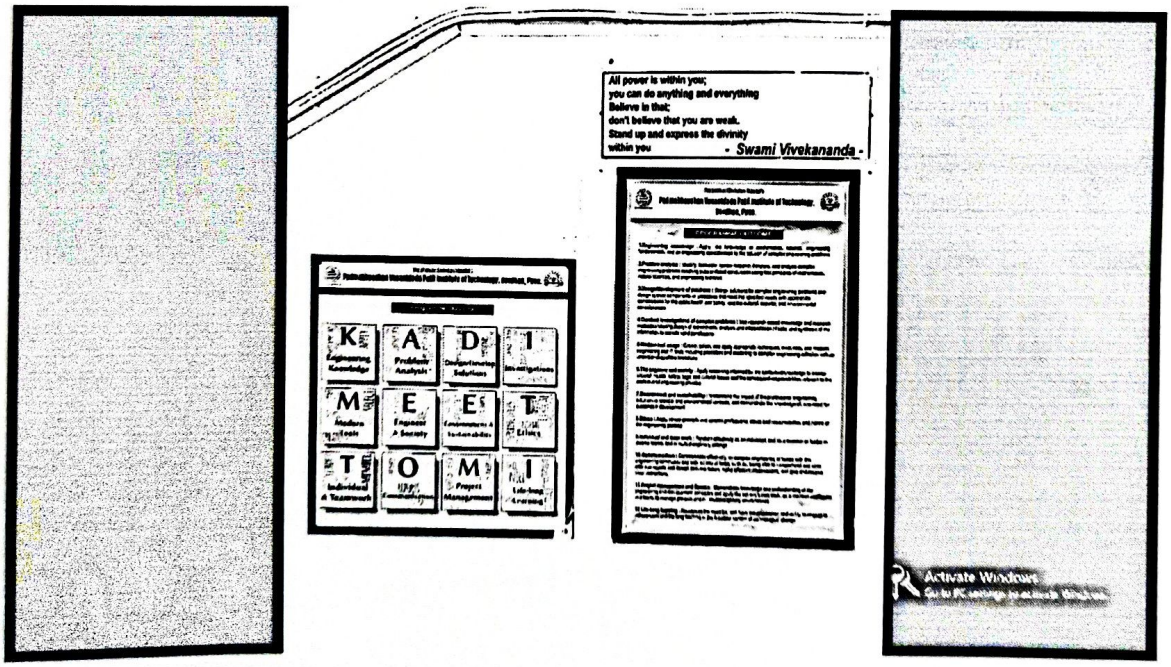

PSO and PO are on Department Laboratory




PSO and PO are on Department Notice Board




PSO and PO are on Institute Website




PO in Department