



Ahmednagar Jilha Maratha Vidya Prasarak Samaj's
Shri Chhatrapati Shivaji Maharaj College of Engineering, Nepti, Ahmednagar

Survey No. 162 & 163, Nepti, Nagar - Kalyan Road, Ahmednagar - 414005. Maharashtra
Phone No :- 0241 -2568383 Unipune - ID CEGA019270 Fax No: - 0241 -2568384
Email: ajmvps123@gmail.com, scsmcoe.anr@gmail.com, Website: www.scoea.org

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2.6.1 Teachers and students are aware of the stated Programme and course outcomes of the Programmes offered by the institution.

Index - 2.6.1

Sr. No	Details of Document	Page No.
01	Course Outcomes of Civil Engineering	001
02	Course Outcomes of Computer Engineering	015
03	Course Outcomes of Electronics and Telecommunication Engineering	029
04	Course Outcomes of Mechanical Engineering	040
05	Course Outcomes of First Year Engineering	061



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Department of Civil Engineering

Year: Second Year

Subject Name	CO's
Building Technology and Architectural Planning	CO1. Identify types of building and basic requirements of building components.
	CO 2. Make use of Architectural Principles and Building byelaws for building construction.
	CO 3. Plan effectively various types of Residential Building forms according to their utility, functions with reference to National Building Code.
	CO 4. Plan effectively various types of Public Buildings according to their utility functions with reference to National Building Code.
	CO 5. Make use of Principles of Planning in Town Planning, Different Villages and Safety aspects.
	CO 6. Understand different services and safety aspects
Mechanics of Structure	CO1. Understand concept of stress-strain and determine different types of stress, strain in determinate, indeterminate homogeneous and composite structures.
	CO 2. Calculate shear force and bending moment in determinate beams for different loading conditions and illustrate shear force and bending moment diagram.
	CO 3. Explain the concept of shear and bending stresses in beams and demonstrate shear and bending stress distribution diagram.
	CO 4. Use theory of torsion to determine the stresses in circular shaft and understand concept of Principal stresses and strains.
	CO 5. Analyze axially loaded and eccentrically loaded column.
	CO 6. Determine the slopes and deflection of determinate beams and trusses.



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Subject Name	CO's
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 vapplication for solving practical problems.
	CO 2. Understand the concept of fluid kinematics with reference to Continuity equation and fluid dynamics with reference to Modified Bernoulli's equation and its.
	CO 3. 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.
	CO 4. 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.
	CO 5. 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
	CO 6. 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
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.
	CO 2. 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.
	CO 3. Apply Statistical methods like correlation, regression and probability theory in data analysis and predictions in civil engineering.
	CO 4. Perform Vector differentiation & integration, analyze the vector fields and apply to fluid flow problems.
	CO 5. Solve Partial differential equations such as wave equation, one and two dimensional heat flow equations.



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Subject Name	CO's
Engineering Geology	CO 1. 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.
	CO 2. 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
	CO 3. Recognize effect of plate tectonics, structural geology and their significance and utility in civil engineering activities.
	CO 4. 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.
	CO 5. Assess the Importance of geological nature of the site, precautions and treatments to improve the site conditions for dams, reservoirs, and tunnels.
	CO 6. Explain geological hazards and importance of ground water and uses of common building stones.
Awareness to Civil Engineering Practices Audit Course I	CO1: Describe functioning/working of different types of industries/sectors in Civil Engineering.
	CO2: Describe drawings and documents required and used in different Civil Engineering works.
	CO3: Understand the importance of Code of Ethics to be practiced by a Civil Engineer and also understand the duties and responsibilities as a Civil Engineer.
	CO4: Understand different health and safety practices on the site.
Geotechnical Engineering	CO1. Identify and classify the soil based on the index properties and its formation process
	CO 2. Explain permeability and seepage analysis of soil by construction of flow net.



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Subject Name	CO's
	CO 3. Illustrate the effect of compaction on soil and understand the basics of stress distribution.
	CO 4. Express shear strength of soil and its measurement under various drainage conditions.
	CO 5. Evaluate the earth pressure due to backfill on retaining structures by using different theories.
	CO 6. Analysis of stability of slopes for different types of soils.
Surveying	CO1. Define and Explain basics of plane surveying and differentiate the instruments used for it.
	CO 2. Express proficiency in handling surveying equipment and analyse the surveying data from these equipment
	CO 3. Describe different methods of surveying and find relative positions of points on the surface of earth.
	CO 4. Execute curve setting for civil engineering projects such as roads, railways etc.
	CO 5. Articulate advancements in surveying such as space based positioning systems
	CO 6. Differentiate map and aerial photographs, also interpret aerial photographs.
Concrete Technology	CO 1. Able to select the various ingredients of concrete and its suitable proportion to achieved desired strength.
	CO 2. Able to check the properties of concrete in fresh and hardened state.
	CO 3. Get acquainted to concreting equipments, techniques and different types of special concrete.
	CO 4. Able to predict deteriorations in concrete and get acquainted to various repairing methods and techniques.



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Subject Name	CO's
Structural Analysis	CO1. Understand the basic concept of static and kinematic indeterminacy and analysis of indeterminate beams.
	CO 2. Analyze redundant trusses and able to perform approximate analysis of multi-story multi-bay frames.
	CO 3. Implement application of the slope deflection method to beams and portal frames.
	CO 4. Analyze beams and portal frames using moment distribution method.
	CO 5. Determine response of beams and portal frames using structure approach of stiffness matrix method.
	CO 6. Apply the concepts of plastic analysis in the analysis of steel structures.
Project Management	CO1. Describe project life cycle and the domains of Project Management.
	CO 2. Explain networking methods and their applications in planning and management
	CO 3. Categorize the materials as per their annual usage and also Calculate production rate of construction equipment
	CO 4. Demonstrates resource allocation techniques and apply it for manpower planning
	CO 5. Understand economical terms and different laws associated with project management
	CO 6. Apply the methods of project selection and recommend the best economical project.
Project Based Learning	CO 1. Identify the community/ practical/ societal needs and convert the idea into a product/ process/ service.
	CO 2. Analyse and design the physical/ mathematical/ ICT model in order to solve identified problem/project.



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Subject Name	CO's
	CO 3. Create; work in team and applying the solution in practical way to specific problem.



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Department of Civil Engineering

Year: Third Year

Subject Name	CO's
Hydrology and Water Resource Engineering	CO 1. Understand government organizations, apply & analyze precipitation & its abstractions.
	CO 2. Understand, apply & analyze runoff, runoff hydrographs and gauging of streams.
	CO 3. Understand, apply & analyze floods, hydrologic routing & Q-GIS software in hydrology
	CO 4. Understand, apply & analyze reservoir planning, capacity of reservoir & reservoir economics.
	CO 5. Understand water logging & water management, apply & analyze ground water hydrology
	CO 6. Understand irrigation, piped distribution network and canal revenue, apply and analyze crop water requirement
Water Supply Engineering	CO1. Define identify, describe reliability of water sources, estimate water requirement for various sectors
	CO 2. Ascertain and interpret water treatment method required to be adopted with respect to source and raw water characteristics
	CO 3. Design various components of water treatment plant and distribution system.
	CO 4. Understand and compare contemporary issues and advanced treatment operations and process available in the market, including packaged water treatment plants.
	CO 5. Design elevated service reservoir capacity and understand the rainwater harvesting.
	CO 6. Understand the requirement of water treatment plant for infrastructure and Government scheme.
Elective I: Construction Management	CO1. Understand the overview of construction sector.
	CO2. Illustrate construction scheduling, work study and work measurement.
	CO 3. Acquaint various labor laws and financial aspects of construction projects.



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Subject Name	CO's
	CO 4. Explain elements of risk management and value engineering.
	CO 5. State material and human resource management techniques in construction.
	CO 6. Explain geological hazards and importance of ground water and uses of common building stones.
Seminar	CO 1. Appraise the current civil engineering research / techniques / developments / interdisciplinary areas.
	CO 2. Review and organize literature survey utilizing technical resources, journals etc.
	CO 3. Evaluate and draw conclusions related to technical content studied.
	CO 4. Demonstrate the ability to perform critical writing by preparing a technical report.
	CO 5. Develop technical writing and presentation skills.
Audit Course I: Professional Ethics and Etiquettes	CO 1. Understand the basic perception of profession, professional ethics, various moral issues and uses of ethical theories
	CO 2. Understand various social issues, industrial standards, code o ethics and role of professional ethics in engineering field.
	CO 3. Follow ethics as an engineering professional and adopt good standards and norms of engineering practice.
	CO 4. Apply ethical principles to resolve situations that arise in their professional lives.
Waste Water Engineering	CO 1. Recall sanitation infrastructure, quantification and characterization of wastewater, natural purification of streams
	CO 2. Design preliminary and primary unit operations in waste water treatment plant
	CO 3. Understand theory and mechanism of aerobic biological treatment system and to design activated sludge process
	CO 4. Understand and design suspended and attached growth wastewater treatment systems
	CO 5. Explain and apply concept of contaminant removal by anaerobic, tertiary and emerging wastewater treatment systems



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Subject Name	CO's
	CO 6. Compare various sludge management systems and explain the potential of recycle and reuse of wastewater treatment
Design of Reinforced Concrete Structures	CO 1. Apply relevant IS provisions to ensure safety and serviceability of structures, understand the design philosophies and behavior of materials: steel & concrete.
	CO 2. Recognize mode of failure as per LSM and evaluate moment of resistance for singly, doubly rectangular, and flanged sections.
	CO 3. Design & detailing of rectangular one way and two-way slab with different boundary conditions
	CO 4. Design & detailing of dog legged and open well staircase
	CO 5. Design & detailing of singly/doubly rectangular/flanged beams for flexure, shear, bond and torsion.
	CO 6. Design & detailing of short columns subjected to axial load, uni-axial/bi-axial bending and their footings.
Remote Sensing and Geographic Information System	CO 1. Articulate fundamentals and principles of RS techniques.
	CO 2. Demonstrate the knowledge of remote sensing and sensor characteristics.
	CO 3. Distinguish working of various spaces-based positioning systems.
	CO 4. Analyze the RS data and image processing to utilize in civil engineering
	CO 5. Explain fundamentals and applications of RS and GIS
	CO 6. Acquire skills of data processing and its applications using GIS
Solid Waste Management	CO 1. Outline solid waste management systems with respect to its generation rate (quantity), sampling, characteristics and regulatory/legal requirements.
	CO 2. Explain and suggest relevant method of storage, collection and transportation of solid waste for the given site condition with justification.
	CO 3. Develop understanding of technological applications for processing and material recovery from solid waste with its economics and design composting system for organic waste.
	CO 4. Describe the fundamental and technological aspects of waste to energy systems from solid waste and to design anaerobic digester and incineration system



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Subject	CO's
	CO5. Outline the design, operation, and maintenance of sanitary landfill and management of legacy waste.
	CO6. Explain the functional element for management of special waste and suggest the relevant method of reuse and recycling for the given type of waste in the given situation.
Internship	CO1.To develop professional competence through industry internship
	CO2. To apply academic knowledge in a personal and professional environment
	CO3. To build the professional network and expose students to future employees
	CO4. Apply professional and societal ethics in their day to day life
	CO5. To become a responsible professional having social, economic and administrative considerations
	CO6. To make own career goals and personal aspirations



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Department of Civil Engineering

Year: Fourth Year

Subject	CO's
Foundation Engineering	CO1. Perform subsurface investigations for foundations using different methods.
	CO2. Estimate the bearing capacity of shallow foundations.
	CO3. Calculate immediate and primary consolidation settlement of shallow foundations.
	CO4. Decide the capacity of a pile and pile group.
	CO5: Understand the steps in geotechnical design of shallow foundations and well foundations
	CO6. Analyze problems related to expansive soil and overcome them using design principles, construction techniques in black cotton soil.
Transportation Engineering	CO1. Understand principles and practices of transportation planning.
	CO2. Demonstrate knowledge of traffic studies, analysis and their interpretation.
	CO3. Design Geometric Elements of road pavement.
	CO4. Evaluate properties of highway materials as a part of road pavement
	CO5. Appraise different types of pavements and their design.
	CO6. Understand the fundamentals of Bridge Engineering and Railway Engineering
Elective III: Integrated Water Resources Planning and Management	CO1. Understand concerned organizations, IWRP & M objectives, principles, challenges, application & analysis of IWRP&M approaches & principles in a case study.
	CO2. Understand PIM, WDS, WALMI, agriculture in the concept of integrated water resources, apply and analyse water requirements for food production
	CO3. Understand assessment of surface and ground water quality, EIA, CPCB regulations, application & analysis of effluent quality standards as per CPCB
	CO4. Understand water economics and funding, application & analysis of planning for a sustainable water future
	CO5. Understand legal regulatory settings of IWRP & M, application & analysis of inter-basin water transfers and IWRP & M



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Subject	CO's
	CO6. Understand flood control & power generation for IWRP & M, application QIGIS for analysis of a basin for IWRP & M
Elective IV: Air Pollution and Control	CO1. Recall air pollution, legislation and regulations.
	CO2. Evaluate air pollutant concentrations as a function of meteorology
	CO3. Interpret sampling results with prescribed standards.
	CO4. Assess emission inventory and air quality models.
	CO5. Compare the air pollution control equipments.
	CO6. Infer indoor air pollution and its mitigation.
Project Stage I	CO1. Appraise the current Civil Engineering research/techniques/developments/interdisciplinary areas.
	CO2. Review and organize literature survey utilizing technical resources, journals etc.
	CO3. Evaluate and draw conclusions related to technical content studied.
	CO4. Demonstrate the ability to perform critical writing by preparing a technical report.
	CO5. Develop technical writing and presentation skills.
Audit Course I a: Stress Management by Yoga	CO1. Develop understanding of Yoga and its impact on human body and mind.
	CO2. Learn different Yogasans
	CO3. Develop an understanding of meditation through pranayama
	CO4. Learn different techniques of Pranayam
Dams and Hydraulics Structures	CO1. Understand types of dams and instrumentation working
	CO2. Execute stability analysis of Gravity Dam
	CO3. Understand types of spillways & Design of Ogee spillway
	CO4. Illustrate the failures and analyze stability of earthen dam
	CO5. Design Canals and understand the canal structures
	CO6. Analysis of the Diversion headwork and Cross Drainage work
Quantity Surveying, Contracts and Tenders	CO1. Understand concept of estimates and prepare approximate estimate for various for Civil Engineering works.



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Subject	CO's
	CO2. Describe tendering process, construction contracts, and aspects of Arbitration and prepare tender documents
	CO3. Prepare detailed estimate of various items of work by different methods and calculate quantity of steel from Bar bending schedule.
	CO4. Apply engineering knowledge to prepare estimate for roads, culverts, and water tank (Elevated storage tank)
	CO5. Apply concepts of specification to draft brief specification, detailed specification and prepare detailed rate analysis report.
	CO6. Evaluate depreciation and valuation of property on the basis of present condition, specifications and market trend
Elective V: Hydropower Engineering	CO1. Understand the classification of power resources & trends in energy use patterns.
	CO2. Identify the components of hydro power plant.
	CO3. Analyze the load assessment for turbines.
	CO4. Prepare the layout of power house based on the various structures need for it
	CO5. Design the turbines and surge tanks.
	CO6. Understand the laws and regulatory aspects of hydroelectric power.
Elective VI: TQM and MIS	CO1. Recognize quality and contribution of quality gurus for evaluation of best practices
	CO2. Relate the functioning and application of TQM & Six Sigma in the domain of construction sector
	CO3. Recommend ISO 9001 principles in preparation of quality manual to construction business
	CO4. Apply management control & certification systems for construction industry
	CO5. Choose TQM process implementation and various quality awards for construction sector
	CO6. Propose MIS for allied fields in construction sector
Project Stage II	CO1. Appraise the current Civil Engineering research/techniques/developments/interdisciplinary areas.
	CO2. Review and organize literature survey utilizing technical resources, journals etc.
	CO3. Evaluate and draw conclusions related to technical content studied.



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Subject	CO's
	CO5. Choose TQM process implementation and various quality awards for construction sector
	CO4. Demonstrate the ability to perform critical writing by preparing a technical report.
	CO5. Develop technical writing and presentation skills.
Audit Course II a: Social Responsibility	CO1. Develop understanding of social responsibility
	CO2. Learn the International framework for Social Responsibility
	CO3. Know the drivers of social responsibility in India
	CO4. Identify the key stakeholders of social responsibility




HOD

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Department of Computer Engineering

Year: Second Year

Subject Name	COs
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
	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
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
Object Oriented Programming	CO1: Analyze the strengths of object oriented programming
	CO2: Design and apply OOP principles for effective programming



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Subject Name	COs
	CO3: Develop the application using object oriented programming language(C++)
	CO4: Apply object-oriented concepts for advanced programming.
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.
	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.
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



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Subject Name	COs
Humanity & Social Science	CO1: Aware of the various issues concerning humans and society.
	CO2: Aware about their responsibilities towards society.
	CO3: Sensitized about broader issues regarding the social, cultural, economic and human aspects, involved in social changes.
	CO4: Able to understand the nature of the individual and the relationship between self and the community.
	CO5: Able to understand major ideas, values, beliefs, and experiences that have shaped human history and cultures.
Engineering Mathematics III	CO1: Solve Linear differential equations, essential in modelling and design of computer-based systems.
	CO2: Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems and image processing.
	CO3: Apply Statistical methods like correlation and regression analysis and probability theory for data analysis and predictions in machine learning.
	CO4: Solve Algebraic and Transcendental equations and System of linear equations using numerical techniques.
	CO5: Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.
Data Structures and Algorithms	CO1: Identify and articulate the complexity goals and benefits of a good hashing scheme for real-world applications.
	CO2: Apply non-linear data structures for solving problems of various domain.
	CO3: Design and specify the operations of a nonlinear-based abstract data type and implement them in a high-level programming language.
	CO4: Analyze the algorithmic solutions for resource requirements and optimization



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Subject Name	COs
	CO5: Use efficient indexing methods and multiway search techniques to store and maintain data.
	CO6: Use appropriate modern tools to understand and analyze the functionalities confined to these secondary storage.
Software Engineering	CO1: Analyze software requirements and formulate design solution for a software.
	CO2: Design applicable solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal and economic concerns.
	CO3: Apply new software models, techniques and technologies to bring out innovative and nonvelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.
	CO4: Model and design User interface and component-level.
	CO5: Identify and handle risk management and software configuration management.
	CO6: Utilize knowledge of software testing approaches, approaches to verification and validation.
	CO7: Construct software of high quality – software that is reliable, and that is reasonably easy to understand, modify and maintain efficient, reliable, robust and cost-effective software solutions
Microprocessor	CO1: Exhibit skill of assembly language programming for the application.
	CO2: Classify Processor architectures.
	CO3: Illustrate advanced features of 80386 Microprocessor.
	CO4: Compare and contrast different processor modes.



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Subject Name	CO's
	CO5: Use interrupts mechanism in applications
	CO6: Differentiate between Microprocessors and Microcontrollers.
	CO7: Identify and analyze the tools and techniques used to design, implement, and debug microprocessor-based systems.
Principles of Programming Languages	CO1: Make use of basic principles of programming languages.
	CO2: Develop a program with Data representation and Computations.
	CO3: Develop programs using Object Oriented Programming language : Java.
	CO4: Develop application using inheritance, encapsulation, and polymorphism.
	CO5: Demonstrate Multithreading for robust application development.
	CO6: Develop a simple program using basic concepts of Functional and Logical programmingparadigm.



HOD

Computer Engineering

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Department of Computer Engineering

Year: Third Year

Subject Name	COS
Database Management Systems	CO1: Analyze and design Database Management System using ER model
	CO2: Implement database queries using database languages
	CO3: Normalize the database design using normal forms
	CO4: Apply Transaction Management concepts in real-time situations
	CO5: Use No SQL databases for processing unstructured data
	CO6: Differentiate between Complex Data Types and analyze the use of appropriate data type
Theory of Computation	CO1: Understand formal language, translation logic, essentials of translation, alphabets, language representation and apply it to design Finite Automata and its variants
	CO2: Construct regular expression to present regular language and understand pumping lemma for RE
	CO3: Design Context Free Grammars and learn to simplify the grammar
	CO4: Construct Pushdown Automaton model for the Context Free Language
	CO5: Devise Turing Machine for the different requirements outlined by theoretical computer science
	CO6: Analyze different classes of problems, and study concepts of NP completeness



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Subject Name	COS
Systems Programming and Operating System	CO1: Analyze and synthesize basic System Software and its functionality.
	CO2: Identify suitable data structures and Design & Implement various System Software
	CO3: Compare different loading schemes and analyze the performance of linker and loader
	CO4: Implement and Analyze the performance of process scheduling algorithms
	CO5: Identify the mechanism to deal with deadlock and concurrency issues
	CO6: Demonstrate memory organization and memory management policies
Computer Networks and Security	CO1: Summarize fundamental concepts of Computer Networks, architectures, protocols and technologies
	CO2: Illustrate the working and functions of data link layer
	CO3: Analyze the working of different routing protocols and mechanisms
	CO4: Implement client-server applications using sockets
	CO5: Illustrate role of application layer with its protocols, client-server architectures
	CO6: Comprehend the basics of Network Security
Software Project Management	CO1: Comprehend Project Management Concepts
	CO2: Use various tools of Software Project Management



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Subject Name	COS
	CO3: Schedule various activities in software projects
	CO4: Track a project and manage changes
	CO5: Apply Agile Project Management
	CO6: Analyse staffing process for team building and decision making in Software Projects and Management
Data Science and Big Data Analytics	CO1: Analyze needs and challenges for Data Science Big Data Analytics
	CO2: Apply statistics for Big Data Analytics
	CO3: Apply the lifecycle of Big Data analytics to real world problems
	CO4: Implement Big Data Analytics using Python programming
	CO5: Implement data visualization using visualization tools in Python programming
	CO6: Design and implement Big Databases using the Hadoop ecosystem
Web Technology	CO1: Implement and analyze behavior of web pages using HTML and CSS
	CO2: Apply the client side technologies for web development
	CO3: Analyze the concepts of Servlet and JSP
	CO4: Analyze the Web services and frameworks



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Subject Name	COS
	CO5: Apply the server side technologies for web development
	CO6: Create the effective web applications for business functionalities using latest web development platforms
Artificial Intelligence	CO1: Identify and apply suitable Intelligent agents for various AI applications
	CO2: Build 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
	CO5: Implement ideas underlying modern logical inference systems
	CO6: Represent complex problems with expressive yet carefully constrained language of representation
Cloud Computing	CO1: Understand the different Cloud Computing environment
	CO2: Use appropriate data storage technique on Cloud, based on Cloud application
	CO3: Analyze virtualization technology and install virtualization software
	CO4: Develop and deploy applications on Cloud
	CO5: Apply security in cloud applications
	CO6: Use advance techniques in Cloud Computing



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Subject Name	COS
Internship	CO1: To demonstrate professional competence through industry internship.
	CO2: To apply knowledge gained through internships to complete academic activities in a professional manner.
	CO3: To choose appropriate technology and tools to solve given problem.
	CO4: To demonstrate abilities of a responsible professional and use ethical practices in day to day life.
	CO5: Creating network and social circle, and developing relationships with industry people.
	CO6: To analyze various career opportunities and decide carrier goals.



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Department of Computer Engineering

Year: Fourth Year

subject	COS
Design and Analysis of Algorithms	CO1: Formulate the problem
	CO2: Analyze the asymptotic performance of algorithms
	CO3: Decide and apply algorithmic strategies to solve given problem
	CO4: Find optimal solution by applying various methods
	CO5: Analyze and Apply Scheduling and Sorting Algorithms.
	CO6: Solve problems for multi-core or distributed or concurrent environments
Machine Learning	CO1: Identify the needs and challenges of machine learning for real time applications.
	CO2: Apply various data pre-processing techniques to simplify and speed up machine learning algorithms.
	CO3: Select and apply appropriately supervised machine learning algorithms for real time applications.
	CO4: Implement variants of multi-class classifier and measure its performance.
	CO5 :Compare and contrast different clustering algorithms.
	CO6: Design a neural network for solving engineering problems.
Blockchain Technology	CO1: Interpret the fundamentals and basic concepts in Blockchain



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subject	COS
	CO2: Compare the working of different blockchain platforms
	CO3: Use Crypto wallet for cryptocurrency based transactions
	CO4: Analyze the importance of blockchain in finding the solution to the real-world problems.
	CO5: Illustrate the Ethereum public block chain platform
	CO6: Identify relative application where block chain technology can be effectively used and implemented
Object oriented Modeling and Design	CO1: Describe the concepts of object-oriented and basic class modelling.
	CO2: Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
	CO3: Choose and apply a befitting design pattern for the given problem
	CO4: To Analyze applications, architectural Styles & software control strategies
	CO5: To develop Class design Models & choose Legacy Systems.
	CO6: To Understand Design Patterns
Mobile Computing	CO1: Develop a strong grounding in the fundamentals of mobile Networks
	CO2: Apply knowledge in MAC, Network, and Transport Layer protocols of Wireless Network
	CO3: Illustrate Global System for Mobile Communications
	CO4: Use the 3G/4G technology based network with bandwidth capacity planning, VLR and HLR identification algorithms



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subject	COS
	CO5: Classify network and transport layer of mobile communication
	CO6: Design & development of various wireless network protocols using simulation tools.
High Performance Computing	CO1: Understand various Parallel Paradigm
	CO2: Design and Develop an efficient parallel algorithm to solve given problem
	CO3: Illustrate data communication operations on various parallel architecture
	CO4: Analyze and measure performance of modern parallel computing systems
	CO5: Apply CUDA architecture for parallel programming
	CO6: Analyze the performance of HPC applications
Deep Learning	CO1: Understand the basics of Deep Learning and apply the tools to implement deep learning applications
	CO2: Evaluate the performance of deep learning models (e.g., with respect to the bias-variance tradeoff, overfitting and underfitting, estimation of test error).
	CO3: To apply the technique of Convolution (CNN) and Recurrent Neural Network (RNN) for implementing Deep Learning models
	CO4: To implement and apply deep generative models.
	CO5: Construct and apply on-policy reinforcement learning algorithms
	CO6: To Understand Reinforcement Learning Process
Natural Language Processing	CO1: Describe the fundamental concepts of NLP, challenges and issues in NLP



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subject	COS
	CO2: Analyze Natural languages morphologically, syntactical and semantically OR Describe the concepts of morphology, syntax, semantics of natural language
	CO3: Illustrate various language modelling techniques
	CO4: Integrate the NLP techniques for the information retrieval task
	CO5: Demonstrate the use of NLP tools and techniques for text-based processing of natural languages
	CO6: Develop real world NLP applications
	Elective-VI Business Intelligence
CO2: Use Data Warehouse & Business Architecture to design a BI system.	
CO3: Build graphical reports	
CO4: Apply different data preprocessing techniques on dataset	
CO5: Implement machine learning algorithms as per business needs	
CO6: Identify role of BI in marketing, logistics, and finance and telecommunication sector	



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Department of Electronics and Telecommunication Engineering

Year: Second Year

Subject Name	CO's
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.
	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.
Electronic 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.
Digital Circuits	CO1: Identify and prevent various hazards and timing problems in a digital design.



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Subject Name	CO's
	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.
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.
	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.
Data Structure	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.
Signals & Systems	CO1: Identify, classify basic signals and perform operations on signals.



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Subject Name	CO's
	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.
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 controlsystem.
	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 controlsystems.
	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.
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.



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Subject Name	CO's
	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.
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++.



HOD

**E&TC Engineering
HEAD**

Department of E & TC Engineering
Shri Chhatrapati Shivaji Maharaj College
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Department of Electronics and Telecommunication Engineering

Year: Third Year

Subject Name	CO's
Digital Communication	CO1: Apply the statistical theory for describing various signals in a communication system.
	CO2: Understand and explain various digital modulation techniques used in digital communication systems and analyze their performance in presence of AWGN noise.
	CO3: Describe and analyze the digital communication system with spread spectrum modulation.
	CO4: Analyze a communication system using information theoretic approach.
	CO5: Use error control coding techniques to improve performance of a digital communication system.
Electromagnetic Field Theory	CO1: Apply the basic electromagnetic principles and determine the fields (E & H) due to the given source.
	CO2: Apply boundary conditions to the boundaries between various media to interpret behavior of the fields on either sides.
	CO3: State, Identify and Apply Maxwell's equations (integral and differential forms) in both the forms (Static, time-varying or Time-harmonic field) for various sources, Calculate the time average power density using Poynting Theorem, Retarded magnetic vector potential.
	CO4: Formulate, Interpret and solve simple uniform plane wave (Helmholtz Equations) equations, and analyze the incident/reflected/transmitted waves at normal incidence.
	CO5: Interpret and Apply the transmission line equation to transmission line problems with load impedance to determine input and output voltage/current at any point on the Transmission line, Find input/load impedance, input/load admittance, reflection coefficient, SWR, V_{max}/V_{min} , length of transmission line using Smith Chart.
	CO6: Carry out a detailed study, interpret the relevance and applications of Electromagnetics.



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Subject Name	CO's
Database Management	CO1: Ability to implement the underlying concepts of a database system.
	CO2: Design and implement a database schema for a given problem-domain using data model.
	CO3: Formulate, using SQL/DML/DDI commands, solutions to a wide range of query and update problems.
	CO4: Implement transactions, concurrency control, and be able to do Database recovery.
	CO5: Able to understand various Parallel Database Architectures and its applications.
	CO6: Able to understand various Distributed Databases and its applications.
Microcontroller	CO1: Understand the fundamentals of microcontroller and programming.
	CO2: Interface various electronic components with microcontrollers.
	CO3: Analyze the features of PIC 18F XXXX.
	CO4: Describe the programming details in peripheral support.
	CO5: Develop interfacing models according to applications.
	CO6: Evaluate the serial communication details and interfaces.
Digital Signal Processing	CO1: Interpret and process discrete/ digital signals and represent DSP system.
	CO2: Analyze the digital systems using the Z-transform techniques.
	CO3: Implement efficient transform and its application to analyze DT signals.
	CO4: Design and implement IIR filters.
	CO5: Design and implement FIR filters.
	CO6: Apply DSP techniques for speech/ biomedical/ image signal processing.



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Subject Name	CO's
Cellular Networks	CO1: Understand fundamentals of wireless communications.
	CO2: Discuss and study OFDM and MIMO concepts.
	CO3: Elaborate fundamentals mobile communication.
	CO4: Describes aspects of wireless system planning.
	CO5: Understand of modern and futuristic wireless networks architecture.
	CO6: Summarize different issues in performance analysis.
Project Management	CO1: Apply the fundamental knowledge of project management for effectively handling the projects.
	CO2: Identify and select the appropriate project based on feasibility study and undertake its effective planning.
	CO3: Assimilate effectively within the organizational structure of project and handle project management related issues in an efficient manner.
	CO4: Apply the project scheduling techniques to create a Project Schedule Plan and accordingly utilize the resources to meet the project deadline.
	CO5: Identify and assess the project risks and manage finances in line with Project Financial Management Process.
	CO6: Develop new products assessing their commercial viability and develop skillsets for becoming successful entrepreneurs while being fully aware of the legal issues related to Product development and Entrepreneurship.
Power Devices & Circuits	CO1: To differentiate based on the characteristic parameters among SCR, GTO, MOSFET & IGBT and identify suitability of the power device for certain applications and understand the significance of device ratings.
	CO2: To design triggering / driver circuits for various power devices.
	CO3: To evaluate and analyze various performance parameters of the different converters and its topologies.



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Subject Name	CO's
	CO4: To understand significance and design of various protections circuits for power devices.
	CO5: To evaluate the performance of uninterruptible power supplies, switch mode power supplies and battery.
	CO6: To understand case studies of power electronics in applications like electric vehicles, solar systems etc.
Digital Image Processing	CO1: Apply knowledge of mathematics for image understanding and analysis.
	CO2: Implement spatial domain image operations.
	CO3: Design and realize various algorithms for image segmentation.
	CO4: Design and realize various algorithms for image Compression.
	CO5: Apply restoration to remove noise in the image.
	CO6: Describe the object recognition system.




HOD

**E&TC Engineering
HEAD**

Department of E & TC Engineering
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Department of Electronics and Telecommunication Engineering

Year: Fourth Year

Subject Name	CO's
Radiation and Microwave Theory	CO1: Apply the fundamentals of electromagnetic to derive free space propagation equation and distinguish various performance parameters of antenna.
	CO2: Identify various modes in the waveguide. Compare: coaxial line, rectangular waveguides & striplines and identify applications of the same.
	CO3: Explore construction and working of principles passive microwave devices/components.
	CO4: Explore construction and working of principles active microwave devices/components.
	CO5: Analyze the structure, characteristics, operation, equivalent circuits and applications of various microwave solid state active devices.
	CO6: Know the various microwave systems, device set ups of microwave measurement devices and
VLSI Design and Technology+E10:E15	CO1: Develop effective HDL codes for digital design.
	CO2: Apply knowledge of real time issues in digital design.
	CO3: Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.
	CO4: Design CMOS circuits for specified applications.
	CO5: Analyze various issues and constraints in design of an ASIC.
	CO6: Apply knowledge of testability in design and Build In Self Test (BIST) circuit.
Cloud Computing	CO1: Understand the basic concepts of Cloud Computing.
	CO2: Describe the underlying principles of different Cloud Service Models.
	CO3: Classify the types of Virtualization.
	CO4: Examine the Cloud Architecture and understand the importance of Cloud Security.



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Subject Name	CO's
	CO5: Develop applications on Cloud Platforms.
	CO6: Evaluate distributed computing and the Internet of Things.
Java Script	CO1: Use basic features of java script.
	CO2: Use relevant data types for developing application in java script.
	CO3: Use the function and objects as self-contained, with data passing in and out through well-defined interfaces in development of small systems.
	CO4: Apply the regular expression for Text matching and manipulation.
	CO5: Explore use of the various aspects of JavaScript object models that are fundamental to the proper use of the language.
	CO6: Develop the application using windows controlling and form handling.
Electronics Product Design	CO1: Understand and explain design flow of design of electronics product.
	CO2: Associate with various circuit design issues and testing.
	CO3: Inferring different software designing aspects and the Importance of product test & test specifications.
	CO4: Summarizing printed circuit boards and different parameters.
	CO5: Estimating assorted product design aspects.
	CO6: Exemplifying special design considerations and importance of documentation.
Fiber Optic Communication	CO1: Explain the working of components and measurement equipments in optical fiber networks.
	CO2: Calculate the important parameters associated with optical components used in fiber optic telecommunication systems.
	CO3: Compare and contrast the performance of major components in optical links.
	CO4: Evaluate the performance viability of optical links using the power and rise time budget analysis.
	CO5: Design digital optical link by proper selection of components and check its viability using simulation tools.



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Subject Name	CO's
	CO6: Compile technical information related to state of art components, standards, simulation tools and current technological trends by accessing the online resources to update their domain
Mobile Computing	CO1: Understand concepts of Mobile Communication.
	CO2: Analyse next generation Mobile Communication System.
	CO3: Understand network layers of Mobile Communication.
	CO4: Understand IP and Transport layers of Mobile Communication.
	CO5: Study of different mathematical models.
	CO6: Understand different mobile applications.
Digital Marketing	CO1: Design websites using free tools like Wordpress and explore it for digital marketing.
	CO2: Apply various keywords for a website & to perform SEO.
	CO3: Understand the various SEM Tools and implement the Digital Marketing Tools.
	CO4: Illustrate the use of Facebook, Instagram and Youtube for Digital Marketing in real life.
	CO5: Use Linked in platform for various campaigning.
	CO6: Understand the importance of recent trends in digital marketing.

HOD

E&TC Engineering

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Department of Mechanical Engineering

Year: Second Year

Subject Name	Cos
Solid Mechanics	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.
Solid Modeling and Drafting	CO.1 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
Engineering Thermodynamics	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.



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Subject Name	Cos
	CO5. ANALYSE the fuel combustion process and products of combustion.
	CO6. SELECT various instrumentations required for safe and efficient operation of steam generator.
Engineering Materials and Metallurgy	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 non-destructive 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.
Electrical and Electronics Engineering	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
Geometric Dimensioning and Tolerancing Lab	CO1.SELECT appropriate IS and ASME standards for drawing
	CO2. READ & ANALYSE variety of industrial drawings
	CO3.APPLY geometric and dimensional tolerance, surface finish symbols in drawing
	CO4.EVALUATE dimensional tolerance based on type of fit, etc.



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Subject Name	Cos
	CO5.SELECT an appropriate manufacturing process using DFM, DFA, etc.
Engineering Mathematics - III	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.
Kinematics of Machinery	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
	CO5.CONSTRUCT cam profile for given follower motion
Applied Thermodynamics	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
Fluid Mechanics	CO1. DETERMINE various properties of fluid



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Subject Name	Cos
	CO2. ANALYZE the results and arrive at valid conclusions.
	CO3.PROPOSE a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge.
	CO4.CONTRIBUTE to society through proposed solutions by strictly following professional ethics and safety measures.
	CO5.USE of technology in proposed work and demonstrate learning in oral and written form.
	CO6.DEVELOP ability to work as an individual and as a team member.



HOD

Mechanical Engineering

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Mechanical Department

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Department of Mechanical Engineering

Year: Third Year

Subject Name	COS
Numerical & Statistical Methods	CO1. SOLVE system of equations using direct and iterative numerical methods.
	CO2. ESTIMATE solutions for differential equations using numerical techniques.
	CO3.DEVELOP solution for engineering applications with numerical integration.
	CO4.DESIGN and CREATE a model using a curve fitting and regression analysis.
	CO5.APPLY statistical Technique for quantitative data analysis.
	CO6.DEMONSTRATE the data, using the concepts of probability and linear algebra.
Heat & Mass Transfer	CO1. ANALYZE & APPLY the modes of heat transfer equations for one dimensional thermal system.
	CO2. DESIGN a thermal system considering fins, thermal insulation and & Transient heat conduction.
	CO3. EVALUATE the heat transfer rate in natural and forced convection & validate with experimentation results.
	CO4. INTERPRET heat transfer by radiation between objects with simple geometries, for black and grey surfaces.
	CO5. ABILITY to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.
	CO6. DESIGN & ANALYSIS of heat transfer equipments and investigation of its performance.
Design of Machine Elements	CO1. DESIGN AND ANALYZE the cotter and knuckle Joints, levers and components subjected to eccentric loading.
	CO2. DESIGN shafts, keys and couplings under static loading conditions.
	CO3. ANALYZE different stresses in power screws and APPLY those in the procedure to design screw jack.
	CO4. EVALUATE dimensions of machine components under fluctuating loads.
	CO5. EVALUATE & INTERPRET the stress developed on the different type of welded and threaded joints.
	CO6. APPLY the design and development procedure for different types of springs.
Mechatronics	CO1. DEFINE key elements of mechatronics, principle of sensor and its characteristics.



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Subject Name	COS
	CO2. UTILIZE concept of signal processing and MAKE use of interfacing systems such as ADC, DAC, Digital I/O.
	CO3. DETERMINE the transfer function by using block diagram reduction technique.
	CO4. EVALUATE Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.
	CO5. APPLY the concept of different controller modes to an industrial application.
	CO6. DEVELOP the ladder programming for industrial application.
Advanced Forming & Joining Processes	CO1. ANALYSE the effect of friction in metal forming deep drawing and IDENTIFICATION of surface defects and their remedies in deep drawing operations
	CO2. ASSESS the parameters for special forming operation and SELECT appropriate special forming operation for particular applications
	CO3. ANALYSE the effect of HAZ on microstructure and mechanical properties of materials
	CO4. CLASSIFY various solid state welding process and SELECT suitable welding processes for particular applications
	CO5. CLASSIFY various advanced welding process and SELECT suitable welding processes for particular applications.
	CO6. INTERPRET the principles of sustainable manufacturing and its role in manufacturing industry.
Machining Science & Technology	CO1. DEFINE metal cutting principles and mechanics of metal cutting and tool life.
	CO2. DESCRIBE features of gear and thread manufacturing processes.
	CO3. SELECT appropriate grinding wheel and demonstrate the various surface finishing processes.
	CO4. SELECT appropriate jigs/fixtures and to draw the process plan for a given component.
	CO5. SELECT & EVALUATE various parameters of process planning.
	CO6. GENERATE CNC program for Turning / Milling processes and generate tool path using CAM software.
Digital Manufacturing Laboratory	CO1. DEVELOP a component using conventional machines, CNC machines and Additive Manufacturing Techniques.
	CO2. ANALYZE cutting tool parameters for machining given job.
	CO3. DEMONSTRATE simulation of manufacturing process using Digital Manufacturing Tools.



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Subject Name	COS
	CO4. SELECT and DESIGN jigs and Fixtures for a given component.
	CO5. DEMONESTRATE different parameters for CNC retrofitting and reconditioning
Skill Development	CO1. APPLY & DEMONSTRATE procedure of assembly & disassembly of various machines.
	CO2. DESIGN & DEVELOP a working/model of machine parts or any new product.
	CO3. EVALUATE fault with diagnosis on the machines, machine tools and home appliances.
	CO4. IDENTIFY & DEMONSTRATE the various activities performed in an industry such as maintenance, design of components, material selection.
Artificial Intelligence & Machine Learning	CO1. DEMONSTRATE fundamentals of artificial intelligence and machine learning.
	CO2. APPLY feature extraction and selection techniques.
	CO3. APPLY machine learning algorithms for classification and regression problems.
	CO4. DEVISE AND DEVELOP a machine learning model using various steps.
	CO5. EXPLAIN concepts of reinforced and deep learning.
	CO6. SIMULATE machine learning model in mechanical engineering problems.
Computer Aided Engineering	CO1: DEFINE the use of CAE tools and DESCRIBE the significance of shape functions in finite element formulations.
	CO2: APPLY the various meshing techniques for better evaluation of approximate results.
	CO3: APPLY material properties and boundary condition to SOLVE 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.
	CO4: ANALYZE and APPLY various numerical methods for different types of analysis.
	CO5: EVALUATE and SOLVE non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method.
	CO6: GENERATE the results in the form of contour plot by the USE of CAE tools.
Design of Transmission Systems	CO1. APPLY the principle of Spur & Helical gear design for industrial application and PREPARE a manufacturing drawing with the concepts of GD&T.
	CO2. EXPLAIN and DESIGN Bevel & Worm gear considering design parameters as per design standards.
	CO3. SELECT & DESIGN Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design



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Subject Name	COS
	parameters.
	CO4. DEFINE and DESIGN various types of Clutches, Brakes, used in automobile.
	CO5. APPLY various concept to DESIGN Machine Tool Gear box, for different applications
	CO6. ELABORATE various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles.
Composite Materials	CO1. DEFINE & COMPARE composites with traditional materials.
	CO2. IDENTIFY & ESTIMATE different parameters of the Polymer Matrix Composite
	CO3. CATEGORISE and APPLY Metal Matrix Process from possessions landscape.
	CO4. DETERMINE volume/weight fraction and strength of Composites.
	CO5. SELECT appropriate testing and inspection method for composite materials.
	CO6. SELECT composites materials for various applications.
Surface Engineering	CO1. DEFINE the basic's principle & mechanism of surface degradation.
	CO2. ANALYSE & SELECT correct corrosion prevention techniques for a different service condition.
	CO3. DEMONSTRATE the role of surface engineering of materials to modify/improve the surface properties.
	CO4. SELECT the suitable surface heat treatments to improve the surface properties.
	CO5. APPLY the surface modification technique to modify surface properties.
	CO6. ANALYSE & EVALUTE various surface coating defects using various testing/characterization method.
Measurement Laboratory	CO1. EVALUATE causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions, noting deviations at actual and by plotting cause and effect diagram, to reduce uncertainty in measurement.
	CO2. ANALYZE strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.
	CO3. EXAMINE surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of metrological equipment's like gauges, jaws of vernier calipers, micrometers, magnifying glasses of height gauge and more, to optimize surface finish accuracy requirements and cost of measurement.
	CO4. MEASURE the dimensional accuracy using Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to



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Subject Name	COS
	reduce measurement lead time.
	CO5. PERFORM Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and mechanisms like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.
	CO6. COMPILE the information of opportunities of entrepreneurs/business in various sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report.
Fluid Power & Control Laboratory	CO1. DEFINE working principle of components used in hydraulic and pneumatic systems.
	CO2. IDENTIFY & EXPLAIN various applications of hydraulic and pneumatic systems.
	CO3. SELECT an appropriate component required for hydraulic and pneumatic systems using manufactures' catalogues.
	CO4. SIMULATE & ANALYSE various hydraulic and pneumatic systems for industrial/mobile applications.
	CO5. DESIGN a hydraulic and pneumatic system for the industrial applications.
	CO6. DESIGN & DEMONESTRATE various IoT, PLC based controlling system using hydraulics and pneumatics.
Internship/Mini project	CO1. DEMONSTRATE professional competence through industry internship.
	CO2. APPLY knowledge gained through internships to complete academic activities in a professional manner.
	CO3. CHOOSE appropriate technology and tools to solve given problem.
	CO4. DEMONSTRATE abilities of a responsible professional and use ethical practices in day to day life.
	CO5. DEVELOP network and social circle, and DEVELOPING relationships with industry people.
	CO6. ANALYZE various career opportunities and DECIDE career goals.



HOD

Mechanical Engineering

HOD

Mechanical Department

**Shri Chhatrapati Shivaji Maharaj College
of Engineering, Nepti, Ahmednagar**



Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

Shri Chhatrapati Shivaji Maharaj College of Engineering, Nepti, Ahmednagar

Survey No. 162 & 163, Nepti, Nagar - Kalyan Road, Ahmednagar - 414005, Maharashtra

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Department of Mechanical Engineering

Year: Fourth Year

Subject Name	COS
Heating Ventilation Air-Conditioning and Refrigeration	CO1.ANALYSE different air-craft refrigeration systems and EXPLAIN the properties, applications and environmental issues of different refrigerants.
	CO2.ANALYSE multi pressure refrigeration system used for refrigeration applications.
	CO3.DISCUSS types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and DESCRIBE Transcritical and ejector refrigeration systems.
	CO4.ESTIMATE cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.
	CO5.DESIGN air distribution system along with consideration of ventilation and infiltration.
	CO6.EXPLAIN the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.
Dynamics of Machinery	CO1. APPLY balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.
	CO2. ANALYZE the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles.
	CO3. ESTIMATE natural frequency for single DOF un-damped & damped free vibratory systems.
	CO4. DETERMINE response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.
	CO5. ESTIMATE natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems.
	CO6. DESCRIBE noise and vibration measuring instruments for industrial / real life applications along with suitable method for noise and vibration control.
Turbomachinery	CO1: VALIDATE impulse moment principle using flat, inclined and curved surfaces and INVESTIGATE performance characteristics of hydraulic turbines.



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Subject Name	COS
	CO2: DETERMINE performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.
	CO3: MEASURE performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.
	CO4: EXPLAIN performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.
Automobile Design	CO1: COMPREHEND the steps involved in the design process of Principal Engine Components.
	CO2: GAIN the knowledge and design of Engine Sub-Systems.
	CO3: COMPUTE the critical dimensions of chassis components involved in the Steering System and Differential and final drive of a vehicle.
	CO4: SELECT the tyres and wheels required for automobile vehicle and design the various types automotive brakes.
	CO5: UNDERSTAND the design concepts of Automotive Suspension system
	CO6: POSSES the knowledge of Vehicle Packaging and System Integration, NVH.
Design of Heat Transfer Equipment's	CO1: EXPLAIN the design aspect of heat exchanger considering fouling factor for Heat Transfer Applications
	CO2: SELECT and DESIGN the double tube heat exchangers for process industry
	CO3: DESIGN the Shell & Tube Heat Exchangers for specified conditions
	CO4: DESIGN the condensers and evaporators for refrigeration applications
	CO5: DESIGN the compact heat exchangers
	CO6: ANALYSE the performance of counter and cross flow cooling tower.
Modern Machining Processes	CO1. UNDERSTAND and ANALYZE the mechanism, process parameters of mechanical assisted modern machining processes.



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Subject Name	COS
	CO2. UNDERSTAND the mechanism, construction and working of laser, plasma and electron beam assisted machining.
	CO3. CLASSIFY and ANALYZE the mechanism, process parameters of the chemical and electrochemical machining.
	CO4. RELATE and ANALYZE the mechanism and select process parameters Electrical Discharge Machining for an application.
	CO5. ILLUSTRATE the application of micromachining processes.
	CO6. SUGGEST appropriate nanomachining process for the specific application.
Industrial Engineering	CO1. EVALUATE the productivity and IMPLEMENT various productivity improvement techniques.
	CO2. APPLY work study techniques and UNDERSTANDS its importance for better productivity.
	CO3. DEMONSTRATE the ability to SELECT plant location, appropriate layout and material handling equipment.
	CO4. USE of Production planning and control tools for effective planning, scheduling and managing the shop floor control.
	CO5. PLAN inventory requirements and EXERCISE effective control on manufacturing requirements.
	CO6. APPLY Ergonomics and legislations for human comfort at work place and UNDERSTANDS the role of value engineering in improving productivity.
Internet of Things	CO1. EXPLAIN the Applications/Devices, Protocols and Communication Models of IoT
	CO2. DEMONSTRATE small Mechanical Engineering IoT oriented applications using Sensors, Actuators, Microcontrollers and Cloud
	CO3. SELECT commonly used IoT Simulation Hardware platforms
	CO4. APPLICATION of Interfacing and Communication Technologies for IoT
	CO5. ILLUSTRATE IoT Application Development and Security of IoT Ecosystem
	CO6. EVALUATE Present and Future Domain specific Applications of IoT Ecosystem



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Subject Name	COS
Computational Fluid Dynamics	CO1. DISTINGUISH and ANALYSE the governing equations of fluid mechanics and heat transfer in various formulations
	CO2. ANALYZE and MODEL the conduction and advection problems
	CO3. ANALYZE and MODEL the Convection-Diffusion problems
	CO4. IDENTIFY and EVALUATE the External/Internal flow and its simulation
	CO5. DISTINGUISH and COMPARE concepts of stability and turbulence.
	CO6. USE and APPLY a CFD tool for effectively solving practical Fluid-Structure Interaction problems
Product Design and Development	CO1. UNDERSTAND Product design and Product development processes
	CO2. UNDERSTAND Processes, tools and techniques for Market Survey & Product Specification Finalization
	CO3. UNDERSTAND Processes, tools and techniques for Concept Inception, Verification and selection
	CO4. UNDERSTAND Processes, tools and techniques for Concept Exploration & Development
	CO5. UNDERSTAND Processes, tools and techniques for Design Verification and Validation
	CO6. UNDERSTAND Processes, tools and techniques for Robust Design and Development
Experimental Methods in Thermal Engineering	CO1. IDENTIFY the suitable instrument for measuring parameters as per performance characteristics
	CO2. ANALYZE experimental data by using different statistical techniques and estimate error
	CO3. DISTINGUISH different methods of temperature measurements and thermal radiation
	CO4. CLASSIFY various pressure measurement instruments and their comparison
	CO5. EXPLAIN different flow measurement methods and flow visualization techniques
	CO6. APPLY knowledge of modern engineering experimentation, including calibration, data acquisition, analysis and interpretation using different AI and ML techniques



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Subject Name	COS
Additive Manufacturing	CO1. USE and CLASSIFY the fundamentals of Additive Manufacturing Technologies for engineering applications.
	CO2. IDENTIFY and CATEGORIZE the methodology to manufacture the products using light-based photo-curing, LASER based technologies and STUDY their applications, benefits.
	CO3. IDENTIFY and CATEGORIZE the methodology to manufacture the products using extrusion-based deposition, inkjet-based technologies and STUDY their applications, benefits.
	CO4. SYNTHESIZE, RECOMMEND and DESIGN the suitable material and process for fabrication and build behavior of verities of product.
	CO5. DESIGN and CONSTRUCT the AM equipment's for appropriate applications and the input CAD model.
	CO6. DEVELOP the knowledge of additive manufacturing for various real-life applications.
Operations Research	CO1. EVALUATE various situations of Games theory and Decision techniques and APPLY them to solve them in real life for decision making.
	CO2. SELECT appropriate model for queuing situations and sequencing situations and FIND the optimal solutions using models for different situations.
	CO3. FORMULATE various management problems and SOLVE them using Linear programming using graphical method and simplex method.
	CO4. FORMULATE variety of problems such as transportation, assignment, travelling salesman and SOLVE these problems using linear programming approach.
	CO5. PLAN optimum project schedule for network models arising from a wide range of applications and for replacement situations find the optimal solutions using appropriate models for the situation.
	CO6. APPLY concepts of simulation and Dynamic programming



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Subject Name	COS
Augmented Reality and Virtual Reality	CO1. UNDERSTAND fundamental Computer Vision, Computer Graphics and Human-Computer Interaction Techniques related to VR/AR
	CO2. UNDERSTAND Geometric Modeling Techniques
	CO3. UNDERSTAND the Virtual Environment
	CO4. ANALYZE and EVALUATE VR/AR Technologies
	CO5. APPLY various types of Hardware and Software in Virtual Reality systems
	CO6. DESIGN and FORMULATE Virtual/Augmented Reality Applications
Data Analytics Laboratory	CO1: UNDERSTAND the basics of data analytics using concepts of statistics and probability.
	CO2: APPLY various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.
	CO3: EXPLORE the data analytics techniques using various tools
	CO4: APPLY data science concept and methods to solve problems in real world context
	CO5: SELECT advanced techniques to conduct thorough and insightful analysis and interpret the results
Project (Stage - I)	CO1. IMPLEMENT systems approach.
	CO2. CONCEPTUALIZE a novel idea / technique into a product. Designability, and Manufacturability.
	CO3. THINK in terms of a multi-disciplinary environment.
	CO4. TAKE ON the challenges of teamwork, and DOCUMENT all aspects of design work.
	CO5. UNDERSTAND the management techniques of implementing a project.
	CO6. DEMONSTRATE the final product for Functionality, Designability, and Manufacturability.



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Computer Integrated Manufacturing	CO1. EXPLAIN CIM and factory automation.
	CO2. UNDERSTAND the integration of hardware and software elements for CIM
	CO3. APPLY CNC program for appropriate manufacturing techniques.
	CO3. APPLY CNC program for appropriate manufacturing techniques.
	CO5. INTERPRET flexible, cellular manufacturing and group technology.
	CO6. ANALYZE the effect of IOT, Industry-4.0 and cloud base manufacturing.
Energy Engineering	CO1: EXPLAIN the power generation scenario, the layout components of thermal power plant and ANALYZE the improved Rankine cycle.
	CO2: ANALYZE the performance of steam condensers, cooling tower system; RECOGNIZE an environmental impact of energy systems and methods to control the same.
	CO3: EXPLAIN the layout, component details of diesel engine plant, hydel and nuclear energy systems.
	CO4: ANALYZE gas and improved power cycles.
	CO5: EXPLAIN the fundamentals of renewable energy systems.
	CO6: EXPLAIN basic principles of energy management, storage and economics of power generation.
Quality and Reliability Engineering	CO1. UNDERSTAND basic concepts of quality and RELATE various quality tools
	CO2. DEVELOP analytical competencies to SOLVE problems on control charts and process capability.
	CO3. UNDERSTAND fundamental concepts of reliability.
	CO4. EVALUATE system reliability.
	CO5. IDENTIFY various failure modes and CREATE fault tree diagram.



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Subject Name	COS
	CO6. UNDERSTAND the concept of reliability centered maintenance and APPLY reliability tests methods
Energy Audit and Management	CO1. EXPLAIN the energy need and role of energy management CO6. EXPLAIN the energy performance improvement by Cogeneration and WHR method
	CO2. CARRY OUT an energy audit of the Institute/Industry/Organization
	CO3. ASSESS the ENCON opportunities using energy economics
	CO4. ANALYSE the energy conservation performance of Thermal Utilities
	CO5. ANALYSE the energy conservation performance of Electrical Utilities
	CO6. EXPLAIN the energy performance improvement by Cogeneration and WHR method
Manufacturing Systems and Simulation	CO1. UNDERSTAND the concepts of manufacturing system, characteristics, type, etc.
	CO2. UNDERSTAND the concepts of Facilities, manufacturing planning & control and Support System.
	CO3. UNDERSTAND the concepts of manufacturing towards solving productivity related problems.
	CO4. DEVELOP a virtual model to solve industrial engineering related issues such as capacity. utilization, line balancing.
	CO5. BUILDING tools to view and control simulations and their results.
	CO6. PLAN the data representation & Evaluate the results of the simulation.
Engineering Economics and Financial Management	CO1. UNDERSTAND the business environment, concepts of economics and demand-supply scenario.
	CO2. APPLY the concepts of costing and pricing to evaluate the pricing of mechanical components.
	CO3. UNDERSTAND accounting systems and analyze financial statements using ratio analysis



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Subject Name	COS
	CO4. SELECT and PREPARE the appropriate type of budget and understand the controlling aspects of budget. CO5. UNDERSTAND the international business and trade system functioning CO6. DEMONSTRATE understanding of financing decisions of new ventures and performance
Organizational Informatics	CO1. Demonstrate an understanding of the scope, purpose and value of information systems in an organization. CO2. Understand the constituents of the information system. CO3. Demonstrate the Understanding of the management of product data and features of various PLM aspects. CO4. Relate the basic concepts of manufacturing system and the ERP functionalities in context of information usage. CO5. Understand the manufacturing execution system and it's applications in functional areas. CO6. Outline the role of the information system in various types of business and allied emerging technologies.
Computational Multi Body Dynamics	CO1. APPLY the basic terminology and concepts used in Multibody Dynamics to solve varieties of motion related applications CO2. IDENTIFY and EVALUATE the types of joints, its kinematics and relevant transformations CO3. DISTINGUISH and COMPARE the formulation methods CO4. DERIVE equations of motion and EVALUATE the kinematics and dynamics of rigid Planar inter-connected bodies CO5. DERIVE equations of motion and EVALUATE the kinematics of rigid Spatial inter-connected bodies CO6. APPLY MBD tool effectively and SIMULATE it to solve and validate practical Multibody Dynamics problems and its solutions
Process Equipment Design	CO1. INTERPRET the different parameters involved in design of process Equipments. CO2. ANALYZE thin and thick walled cylinder



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Subject Name	COS
	CO3. DESIGN cylindrical vessel, spherical vessel, tall vessels and thick walled high pressure vessels
	CO4. DESIGN different process Equipments and select pump, compressor etc. and auxiliary services
	CO5. EVALUATE Process parameters and their correlation
	CO6. APPLY the concepts of process equipment design for specific applications
Renewable Energy Technologies	CO1. DESCRIBE fundamentals, needs and scopes of renewable energy systems.
	CO2. EXPLAIN performance aspects of flat and concentric solar collectors along with applications.
	CO3. DESIGN solar photovoltaic system for residential applications.
	CO4. DESIGN AND ANALYSIS of wind energy conversion system.
	CO5. APPLY Installation practices of Wind and Solar Photovoltaic Systems for grid connection.
	CO6. DETERMINE performance parameters of bio-energy conversion systems.
Automation and Robotics	CO1. UNDERSTAND the basic concepts of Automation
	CO2. UNDERSTAND the basic concepts of Robotics
	CO3. IDENTIFY and EVALUATE appropriate Drive for Robotic Applications
	CO4. COMPARE and SELECT End-effectors and Sensors as per Application
	CO5. DEVELOPE the Mathematical Modeling Approaches of Robot
	CO6. EVALUATE the fundamentals of robot programming and CLASSIFY the Applications
Industrial Psychology and Organizational Behavior	CO1. DEMONSTRATE fundamental knowledge about need and scope of industrial - organizational psychology and behavior.
	CO2. ANALYZE the job requirement, have understanding of fatigue, boredom and improve the job satisfaction.



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Subject Name	COS
	<p>CO3. UNDERSTAND the approaches to enhance the performance.</p> <p>CO4. KNOWLEDGE of theories of organizational behavior, learning and social-system.</p> <p>CO5. UNDERSTAND the mechanism of group behavior, various aspects of team, leadership and conflict management.</p> <p>CO6. EVALUATE the organizational culture, manage the change and understands organizational development approaches.</p>
Electrical and Hybrid Vehicle	<p>CO1. UNDERSTAND the basics related to e-vehicle</p> <p>CO2. CLASSIFY the different hybrid vehicles</p> <p>CO3. IDENTIFY and EVALUATE the Prime Movers, Energy Storage and Controllers</p> <p>CO4. DISCOVER and CATAGORIZE the Electric Vehicle Configuration with respect to Propulsion, Power distribution and Drive-Train Topologies</p> <p>CO5. DEVELOP body frame with appropriate suspension system and TESTING of for e-Vehicles</p> <p>CO6. CLASSIFY and EVALUATE Battery Charging techniques and management</p>
Mechanical Systems Analysis Laboratory	<p>CO1. DEVELOP an understanding of the Systems Engineering Process and the range of factors that influence the product need, problem-specific information collection, Problem Definition, Task Specification, Solution Concept inception, Concept Development, System's Mathematical Modelling, Synthesis, Analysis, final solution Selection, Simulation, Detailed Design, Construction, Prototyping, Testing, fault-finding, Diagnosis, Performance Analysis, and Evaluation, Maintenance, Modification, Validation, Planning, Production, Evaluation and use of a system using manual calculation, computational tools</p> <p>CO2. ILLUSTRATE the concepts and USE the developed skill-set of use of computational tools (FEA, CFD, MBD, FSI, CAE) to automate the complete product development process.</p>



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Subject Name	COS
	CO3. EVALUATE the knowledge of new developments and innovations in technological systems to carry forward to next stage of employment after passing your Undergraduate Degree Examination.
	CO4. APPRAISE how technologies have transformed people's lives and can be used to SOLVE challenges associated with climate change, efficient energy use, security, health, education and transport, which will be coming your ways in the coming future.
	CO5. PRIORITIZE the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose.
	CO6. INVENT yourself to face the challenges of future technologies and their associated Problems.



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Department of First Year Engineering

Year: First Year

Subject Name	Cos
Basic Electrical Engineering	CO1: To introduce fundamental concepts, various laws-principles and theorems associated with electrical systems.
	CO2: To impart basic knowledge of all electrical quantities such as current, voltage, power, energy, frequency, along with different types of fields.
	CO3: To provide knowledge about fundamental parameters such as resistance, inductance and capacitance and magnetic circuits, AC and DC circuits.
	CO4: To provide knowledge of the concepts of transformer, different energy conversions techniques.
Engineering Chemistry	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 specialty polymers and Nano materials.
	CO4: To study conventional and alternative fuels with respect to their properties and application.
	CO5: To study spectroscopic techniques for chemical analysis.
	CO6: To understand corrosion mechanism and preventive methods for corrosion control.
Engineering Mathematics -- I	Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems.
	The Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems.



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Subject Name	Cos
	<p>To deal with derivative of functions of several variables that are essential in various branches of Engineering.</p> <p>To apply the concept of Jacobian to find partial derivative of implicit function and functional dependence. Use of partial derivatives in estimating error and approximation and finding extreme values of the function</p> <p>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</p>
Engineering Physics	<p>Develop understanding of interference, diffraction and polarization; connect it to few engineering applications.</p> <p>Learn basics of lasers and optical fibers and their use in some applications.</p> <p>Understand concepts and principles in quantum mechanics. Relate them to some applications.</p> <p>Understand theory of semiconductors and their applications in some semiconductor devices.</p> <p>Summarize basics of magnetism and superconductivity. Explore few of their technological applications.</p> <p>Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nano materials and their application</p>
Systems in Mechanical Engineering	<p>Describe and compare the conversion of energy from renewable and non-renewable energy sources</p> <p>Explain basic laws of thermodynamics, heat transfer and their applications</p> <p>List down the types of road vehicles and their specifications</p> <p>Illustrate various basic parts and transmission system of a road vehicle</p> <p>Discuss several manufacturing processes and identify the suitable process</p> <p>Explain various types of mechanism and its application</p>



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Subject Name	Cos
Programming and Problem Solving	Inculcate and apply various skills in problem solving.
	Choose most appropriate programming constructs and features to solve the problems in diversified domains
	Exhibit the programming skills for the problems those require the writing of well-documented programs including use of the logical constructs of language, Python.
	Demonstrate significant experience with the Python program development environment
	Inculcate and apply various skills in problem solving.
Workshop Practice	Familiar with safety norms to prevent any mishap in workshop
	Able to handle appropriate hand tool, cutting tool and machine tools to manufacture a job.
	Able to understand the construction, working and functions of machine tools and their parts.
	Able to know simple operations (Turning and Facing) on a centre lathe. Note 1.
Environmental Studies-I	To explain the concepts and strategies related to sustainable development and various components of environment
	To examine biotic and abiotic factors within an ecosystem, to identify food chains, webs, as well as energy flow and relationships.
	To identify and analyze various conservation methods and their effectiveness in relation to renewable and nonrenewable natural resources.
	To gain an understanding of the value of biodiversity and current efforts to conserve biodiversity on national and local scale.
Basic Electronics Engineering	Explain the working of P-N junction diode and its circuits
	Identify types of diodes and plot their characteristics and also can compare BJT with MOSFET.
	Build and test analog circuits using OPAMP and digital circuits using universal/basic gates and flip flops.



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Subject Name	Cos
	Use different electronics measuring instruments to measure various electrical parameters.
	Select sensors for specific applications.
	Describe basic principles of communication systems.
Engineering Graphics	Draw the fundamental engineering objects using basic rules and able to construct the simple geometries.
	Construct the various engineering curves using the drawing instruments
	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.
	Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment
	Draw the development of lateral surfaces for cut section of geometrical solids.
	Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools.
Project Based Learning	Project based learning will increase their capacity and learning through shared cognition
	Students able to draw on lessons from several disciplines and apply them in practical way.
	Learning by doing approach in PBL will promote long-term retention of material and replicable skill, as well as improve teachers' and students' attitudes towards learning.

M. Bhosale
HOD