
	<b>Akhil Bharatiya Maratha Shikshan Parishad's Anantrao Pawar College of Engineering &amp; Research</b>		
	Record No.: ADM/D/036B Revision: 00	DoI: 21/01/2019	
<b>Internal Correspondence For Department</b>			

## Department of Computer Engineering Course Outcomes (CO)

### Class: Second Year [2019 Course]

#### 1 210241: Discrete Mathematics


- CO1: Design and analyze real world engineering problems by applying set theory, propositional logic and mathematical induction
- CO2: Develop skill in-expressing mathematical properties of relation and function
- CO3: Identify number of logical possibilities of events to design professional engineering Solutions
- CO4: Model and solve computing problem using tree and graph Analyze the properties of binary operations and evaluate the algebraic structure
- CO5: Apply abstract algebra in combinatorics, coding theory and questions regarding geometric constructions

#### 2 210242: Fundamentals of Data Structures

- CO1: To demonstrate a detailed understanding of behavior 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.

#### 3 210243: Object Oriented Programming



- CO1: Analyze the strengths of object oriented programming
- CO2: Design and apply OOP principles for effective programming
- CO3: Develop the application using object oriented programming language(C++)
- CO4: Apply object-oriented concepts for advanced programming.

  
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**4 210244: 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.

**5 210245: 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

**6 210246: 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.

  
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**7 210252: Mathematics III**

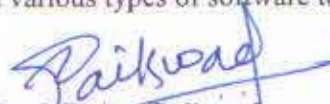
- CO1: Solve Linear differential equations, Essential in modeling and design of computer-based System.
- CO2: Apply concept of Fourier transform and Z-transform and its application to continuous and discrete system and image processing.
- CO3: Apply statistical methods like correlation and regression 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.

**8 210253: Data Structures & Algorithms**

- CO1: To identify & articulate the complexity goals and benefits of a good hashing scheme for real- world applications.
- CO2: To apply non-linear data structures for solving problems of various domain.
- CO3: To design and specify the operations of a nonlinear-based abstract data type and implement them in a high-level programming language.
- CO4: To analyze the algorithmic solutions for resource requirements and optimization
- CO5: To use efficient indexing methods and multiway search techniques to store and maintain data.
- CO6: To use appropriate modern tools to understand and analyze the functionalities confined to the secondary storage.



**9 210254: Software Engineering**

- CO1: Apply software engineering principles to develop software.
- CO2: Analyze software requirements and formulate design solution for a software. CO3: Explain concepts of project estimation, planning and scheduling.
- CO4: Explain risk management and software configuration management.
- CO5: Explain various types of software testing.

  
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**10 210255: Microprocessor**

- CO1: To apply the assembly language programming to develop small real life embedded application.
- CO2: To understand the architecture of the advanced processor thoroughly to use the resources for programming
- CO3: To understand the higher processor architectures descended from 80386 architecture

**11 210256: Principles of Programming Languages**



- CO1: Make use of basic principles of programming languages
- CO2: Able to develop a program with Data representation and Computations
- CO3: Able to develop programs using Object Oriented Programming language : Java
- CO4: Develop application using inheritance, encapsulation, and polymorphism
- CO5: Able to demonstrate Applet and Multithreading for robust application development
- CO6: Able to develop a simple program using basic concepts of Functional and Logical programming paradigm

  
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## Department of Computer Engineering Course Outcomes (CO)

### Class: Third Year [2019 Course]

#### 1 310241: 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 NoSQL databases for processing unstructured data
- CO6: Differentiate between Complex Data Types and analyze the use of appropriate data types

#### 2 310242: 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: Design Turing Machine for the different requirements outlined by theoretical computer science
- CO6: Understand different classes of problems, classify and analyze them and study concepts of NP completeness

#### 3 310243: 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

  
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#### 4 310244: 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

#### 5 310245(D): Software Project Management

CO1: Comprehend Project Management Concepts

CO2: Use various tools of Software Project Management

CO3: Schedule various activities in software projects

CO4: Track a project and manage changes

CO5: Apply Agile Project Management

CO6: Analyze staffing process for team building and decision making in Software Projects and Management

#### 6 310249: Seminar and Technical Communication

CO1: Analyze a latest topic of professional interest

CO2: Enhance technical writing skills

CO3: Identify an engineering problem, analyze it and propose a work plan to solve it

CO4: Communicate with professional technical presentation skills

#### 7 310251: Data Science and Big Data Analytics

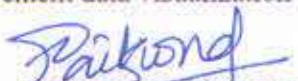
CO1: Analyze needs and challenges for Data Science Big Data Analytics

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

  
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CO6: Design and implement Big Databases using the Hadoop ecosystem

**8 310252: 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

CO5: Apply the server side technologies for web development

CO6: Create the effective web applications for business functionalities using latest web development platforms

**9 310253: 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

**10 310254(D): Software Modelling and Architecture**

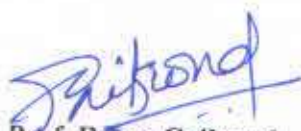
CO1: Analyze the problem statement (SRS) and choose proper design technique for designing web-based/desktop application

CO2: Design and analyze an application using UML modeling as fundamental tool

CO3: Evaluate software architectures

CO4: Use appropriate architectural styles and software design patterns

CO5: Apply appropriate modern tool for designing and modeling

  
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**11 310255: 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  
Course Outcomes (CO)**

**Class: Final Year [2019 Course]**

**1 410241: 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

**2 410242: 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.

**3 410243: Blockchain Technology**

CO1: Interpret the fundamentals and basic concepts in Blockchain

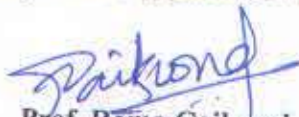
CO2: Compare the working of different blockchain platforms

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.



  
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**4 410244(D): 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

**5 410245 (D): Software Testing and Quality Assurance**

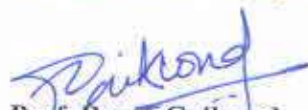
- CO1: Describe fundamental concepts in software testing such as manual testing, automation testing and software quality assurance.
- CO2: Design and Develop project test plan, design test cases, test data, and conduct test operations.
- CO3: Apply recent automation tool for various software testing for testing software.
- CO4: Apply different approaches of quality management, assurance, and quality standard to software system.
- CO5: Apply and analyze effectiveness Software Quality Tools.
- CO6: Apply tools necessary for efficient testing framework.

**6 410250: 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

**7 410251: Deep Learning**

- CO1: Understand the basics of Deep Learning and apply the tools to implement deep learning applications





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CO2: Evaluate the performance of deep learning models (e.g., with respect to the bias-variance trade-off, overfitting and under fitting, 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

**8 410252 (B): Image Processing**

CO1: Apply Relevant Mathematics Required for Digital Image Processing.

CO2: Apply Special and Frequency Domain Method for Image Enhancement.

CO3: Apply algorithmic approaches for Image segmentation.

CO4: Summarize the Concept of Image Compression and Object Recognition.

CO5: Explore the Image Restoration Techniques.

CO6: Explore the Medical and Satellite Image Processing Applications.

**9 410253A: Elective-VI Business Intelligence**

CO1: Differentiate the concepts of Decision Support System & 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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## Second Year Information Technology

### Program Outcomes

PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, Engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development of Solutions	An ability to design, implement, and evaluate a software or a Software/hardware system, component, or process to meet desired needs within realistic constraints.
PO4	Conduct Investigations of Complex Problems	An ability to identify, formulate, and provide systematic solutions to complex engineering/Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT Professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems with necessary constraints and Assumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solution for the local and global Impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security and Social issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or as a team Member to accomplish a desired goal(s).
PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-Curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in engineering community at Large by means of effective presentations, report writing, paper publications, demonstrations.

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PO12 Life-long Learning

An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary For professional practice.

### Program Specific Outcomes (PSO)

PSO1 An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of Information processing systems and applications in the interdisciplinary domain.

PSO2 An ability to analyze a problem, and identify and define the computing Infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.

PSO3 An understanding of professional, business and business processes, ethical, legal, Security and social issues and responsibilities.

PSO4 Practice communication and decision-making skills through the use of appropriate Technology and be ready for professional responsibilities.

### Course Outcome

#### 1 214441: Discrete Mathematics

CO1: Formulate and apply formal proof techniques and solve the problems with logical reasoning.

CO2: Analyze and evaluate the combinatorial problems by using probability theory.

CO3: Apply the concepts of graph theory to devise mathematical models.

CO4: Analyze types of relations and functions to provide solution to computational problems.

CO5: Identify techniques of number theory and its application.

CO6: Identify fundamental algebraic structures.

#### 2 214442: Logic Design & Computer Organization

CO1: Perform basic binary arithmetic & simplify logic expressions.

CO2: Grasp the operations of logic ICs and Implement combinational logic functions using ICs.

CO3: Comprehend the operations of basic memory cell types and Implement sequential logic functions using ICs.

CO4: Elucidate the functions & organization of various blocks of CPU.

CO5: Understand CPU instruction characteristics, enhancement features of CPU.

CO6: Describe an assortment of memory types (with their characteristics) used in computer systems and basic

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principle of interfacing input, output devices.

**3 214443: Data Structure & Algorithms**

- CO1: Perform basic analysis of algorithms with respect to time and space complexity.
- CO2: Select appropriate searching and/or sorting techniques in the application development.
- CO3: Implement abstract data type (ADT) and data structures for given application.
- CO4: Design algorithms based on techniques like brute-force, divide and conquer, greedy, etc.
- CO5: Apply implement learned algorithm design techniques and data structures to solve problems.
- CO6: Design different hashing functions and use files organizations.

**4 214448: Object Oriented Programming Lab**

- CO1: Differentiate various programming paradigms.
- CO2: Identify classes, objects, methods, and handle object creation, initialization, and Destruction to model real-world problems.
- CO3: Identify relationship among objects using inheritance and polymorphism principles.
- CO4: Handle different types of exceptions and perform generic programming.
- CO5: Use of files for persistent data storage for real world application.
- CO6: Apply appropriate design patterns to provide object-oriented solutions.

**5 214445: Basics of Computer Network**

- CO1: Understand and explain the concepts of communication theory and compare functions of OSI and TCP/IP model.
- CO2: Analyze data link layer services, error detection and correction, linear block codes, cyclic codes, framing and flow control protocols.
- CO3: Compare different access techniques, channelization and IEEE standards.
- CO4: Apply the skills of subnetting, supernetting and routing mechanisms.
- CO5: Differentiate IPv4 and IPv6.
- CO6: Illustrate services and protocols used at transport layer.

**6 207003: 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 & regression analysis and probability theory for data analysis and predictions in machine learning.
- CO4: Solve Algebraic & 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.

**7 214451: Processor Architecture**

- CO1: Apprehend architecture and memory organization of PIC 18 microcontroller.
- CO2: Implement embedded C programming for PIC 18.
- CO3: Use concepts of timers and interrupts of PIC 18.
- CO4: Demonstrate real life applications using PIC 18.
- CO5: Analyze architectural details of ARM processor.



- 8     **214452: Database Management System**  
CO1: Apply fundamental elements of database management systems.  
CO2: Design ER-models to represent simple database application scenarios.  
CO3: Formulate SQL queries on data for relational databases.  
CO4: Improve the database design by normalization & to incorporate query processing.  
CO5: Apply ACID properties for transaction management and concurrency control.  
CO6: Analyze various database architectures and technologies
- 9     **214453: Computer Graphics**  
CO1: Apply mathematical and logical aspects for developing elementary graphics operations like scan conversion of points, lines, circle, and apply it for problem solving.  
CO2: Employ techniques of geometrical transforms to produce, position and manipulate objects in 2 dimensional and 3-dimensional space respectively.  
CO3: Describe mapping from a world coordinates to device coordinates, clipping, and projections in order to produce 3D images on 2D output device.  
CO4: Apply concepts of rendering, shading, animation, curves and fractals using computer graphics tools in design, development and testing of 2D, 3D modeling applications.  
CO5: Perceive the concepts of virtual reality.
- 10    **214454: Software Engineering**  
CO1: Classify various software application domains.  
CO2: Analyze software requirements by using various modeling techniques.  
CO3: Translate the requirement models into design models.  
CO4: Apply planning and estimation to any project.  
CO5: Use quality attributes and testing principles in software development life cycle.  
CO6: Discuss recent trends in Software engineering by using CASE and agile tools.



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### Third Year Information Technology

#### Program Outcomes

PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development of Solutions	An ability to design, implement, and evaluate software or a software /hardware system, component, or process to meet desired needs within realistic constraints.
PO4	Conduct Investigation of Complex Problems	An ability to identify, formulate, and provide schematic solutions to complex engineering /Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer- based systems with necessary constraints and assumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security and social issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).

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PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies /tools with the help of electives, profession along animations and extra-curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
PO12	Life-long Learning	An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.

### Program Specific Outcomes(PSO)

PSO1	An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of information processing systems and applications in the interdisciplinary domain.
PSO2	An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.
PSO3	An understanding of professional, business and business processes, ethical, legal, security and social issues and responsibilities.
PSO4	Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.

### Course Outcome

#### 1 314441: Theory of Computation

**CO1:** Construct finite automata and its variants to solve computing problems. **CO2:** Write regular expressions for the regular languages and finite automata. **CO3:** Identify types of grammar, design and simplify Context Free Grammar. **CO4:** Construct Pushdown Automata machine for the Context Free Language. **CO5:** Design and analyze Turing machines for formal languages. **CO6:** Understand decidable and undecidable problems, analyze complexity classes.

#### 2 314442: Operating Systems

**CO1:** Explain the role of Modern Operating Systems.



- CO2: Apply the concepts of process and thread scheduling.
- CO3: Illustrate the concept of process synchronization, mutual exclusion and the deadlock.
- CO4: Implement the concepts of various memory management techniques.
- CO5: Make use of concept of I/O management and File system.
- CO6: Understand Importance of System software.

3 **314443: Machine Learning**

- CO1: Apply basic concepts of machine learning and different types of machine learning algorithms.
- CO2: Differentiate various regression techniques and evaluate their performance. CO3: Compare different types of classification models and their relevant application. CO4: Illustrate the tree-based and probabilistic machine learning algorithms.
- CO5: Identify different unsupervised learning algorithms for the related real-world problems.
- CO6: Apply fundamental concepts of ANN.

4 **314444: Human Computer Interaction**

- CO1: Explain importance of HCI study and principles of user-centered design (UCD) approach.
- CO2: Develop understanding of human factors in HCI design.
- CO3: Develop understanding of models, paradigms, and context of interactions.
- CO4: Design effective user-interfaces following a structured and organized UCD process.
- CO5: Evaluate usability of a user-interface design.
- CO6: Apply cognitive models for predicting human-computer-interactions.

5 **314445(B): Elective -I : Advanced Database Management System**

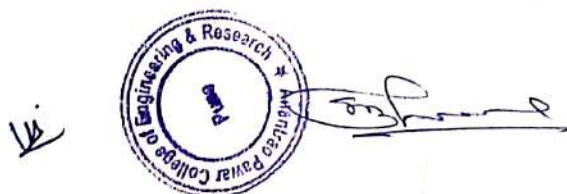
- CO1: Differentiate relational and object-oriented databases.
- CO2: Illustrate parallel & distributed database architectures.
- CO3: Apply concepts of NoSQL Databases.
- CO4: Explain concepts of data warehouse and OLAP technologies.
- CO5: Apply data mining algorithms and various software tools.
- CO6: Comprehend emerging and enhanced data models for advanced applications.

6 **314451: Computer Network and Security**

- CO1: Explain Responsibilities, services offered and protocol used at application layer of network
- CO2: Apply concepts of wireless network and different wireless standards.
- CO3: Recognize the Adhoc Network's MAC layer, routing protocol and Sensor network architecture. CO4: Implement the principal concepts of network security and Understand network security threats, security services, and countermeasures
- CO5: Apply basic cryptographic techniques in application development.
- CO6: Gain a good comprehension of the landscape of cyber security Vulnerabilities & describe typical threats to modern digital systems.

7 **314452: Data Science and Big Data Analytics**

- CO1: Understand Big Data primitives.



**CO2:** Learn and apply different mathematical models for Big Data.

**CO3:** Demonstrate Big Data learning skills by developing industry or research applications.

**CO4:** Analyze and apply each learning model comes from a different algorithmic approach and it will perform differently under different datasets.

**CO5:** Understand, apply and analyze needs, challenges and techniques for big data visualization.

**CO6:** Learn different programming platforms for big data analytics.

8 **314453: Web Application Development**

**CO1:** Develop Static and Dynamic website using technologies like HTML, CSS, and Bootstrap.

**CO2:** Demonstrate the use of web scripting languages.

**CO3:** Develop web application with Front End & Back End Technologies.

**CO4:** Develop mobile website using JQuery Mobile.

**CO5:** Deploy web application on cloud using AWS.

9 **314454 (C): Elective-II- ( Cloud Computing)**

**CO1:** Articulate the main concepts, key technologies and fundamentals of cloud computing.

**CO2:** Understand cloud enabling technologies and virtualization.

**CO3:** Analyze various cloud programming models and apply them to solve problems on the cloud.

**CO4:** Explain data storage and major security issues in the cloud.

**CO5:** Understand trends in ubiquitous cloud and internet of things.

**CO6:** Explore future trends of cloud computing.

10 **314455: Internship**

**CO1:** Develop professional competence through industry internship.

**CO2:** Apply academic knowledge in a personal and professional environment

**CO3:** Build the professional network and expose students to future employees.

**CO4:** Apply professional and societal ethics in their day-to-day life.

**CO5:** Become a responsible professional having social, economic and administrative considerations.

**CO6:** Make own career goals and personal aspirations.

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## Final Year Information Technology

### Program Outcomes

PO1	Engineering knowledge	An ability to apply knowledge of mathematics, computing, science, engineering and technology.
PO2	Problem analysis	An ability to define a problem and provide a systematic solution with the help of conducting experiments, analyzing the problem and interpreting the data.
PO3	Design / Development of Solutions	An ability to design, implement, and evaluate software or a software /hardware system, component, or process to meet desired needs within realistic constraints.
PO4	Conduct Investigation of Complex Problems	An ability to identify, formulate, and provide essay schematic solutions to complex engineering /Technology problems.
PO5	Modern Tool Usage	An ability to use the techniques, skills, and modern engineering technology tools, standard processes necessary for practice as a IT professional.
PO6	The Engineer and Society	An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer- based systems with necessary constraints and assumptions.
PO7	Environment and Sustainability	An ability to analyze and provide solution for the local and global impact of information technology on individuals, organizations and society.
PO8	Ethics	An ability to understand professional, ethical, legal, security and social issues and responsibilities.
PO9	Individual and Team Work	An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).
PO10	Communication Skills	An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies /tools with the help of electives, profession along animations and extra- curricular activities.
PO11	Project Management and Finance	An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.



PO12	Life-long Learning	An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.
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### Program Specific Outcomes(PSO)

- PSO1** An ability to apply the theoretical concepts and practical knowledge of Information Technology in analysis, design, development and management of Information processing systems and applications in the Interdisciplinary domain.
- PSO2** An ability to analyze a problem, and identify and define the computing infrastructure and operations requirements appropriate to its solution. IT graduates should be able to work on large-scale computing systems.
- PSO3** An understanding of professional, business and business processes, ethical, legal, security and social issues and responsibilities.
- PSO4** Practice communication and decision-making skills through the use of appropriate technology and be ready for professional responsibilities.

### Course Outcome

- 1 **414453: Information and Cyber Security**
  1. Use basic cryptographic techniques in application development.
  2. Apply methods for authentication, access control, intrusion detection and prevention.
  3. To apply the scientific method to digital forensics and perform forensic investigations.
  4. To develop computer forensics awareness.
  5. Ability to use computer forensics tools.
- 2 **414454: Machine Learning and Applications**
  1. Model the learning primitives.
  2. Build the learning model.
  3. Tackle real world problems in the domain of Data Mining and Big Data Analytics, Information Retrieval, Computer vision, Linguistics and Bioinformatics.
- 3 **414455: Software Design and Modeling**
  1. To teach the student the fundamental aspects of different object oriented methodologies and unified




approach along with Unified Modeling Language (UML), in terms of "how to use" it for the purpose of specifying and developing software.

2. Explore and analyze use case modeling, domain/ class modeling.
3. To teach the student Interaction and behavior modeling.
4. Aware students with design process in software development.
5. Orient students with the software design principles and patterns.
6. Enable students to learn the architectural design guidelines in various type of application

Development.

4

#### **414456A: Elective-I**

##### **Wireless Communications**

1. To provide fundamental knowledge that forms the basis for wireless communication systems and Networks.
2. For creating foundation of cellular concepts which will be useful for understanding the fundamentals of cellular mobile communication systems design.
3. To provide knowledge about the Mobile Radio Propagation models and various wireless channel effects.
4. To Study various Multiple Access techniques.
5. Give Students the exposure to recent emerging trends in wireless communication like Software Defined Radio as well.
6. To Provide overview of recent trends like wireless communication like Wi-Fi, Wi-MAX, 4G, UWB Radio and Wireless Adhoc Networks.

5

#### **414457C: Elective-II**

##### **Software Testing and Quality Assurance**

1. Test the software by applying testing techniques to deliver a product free from bugs.
2. Investigate the scenario and to select the proper testing technique.
3. Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.
4. Understand how to detect, classify, prevent and remove defects.
5. Choose appropriate quality assurance models and develop quality.
6. Ability to conduct formal inspections, record and evaluate results of inspections.

6

#### **414462: Distributed Computing System**

1. Understand the principles and desired properties of distributed systems based on different application areas.
2. Understand and apply the basic theoretical concepts and algorithms of distributed systems in problem solving.
3. Recognize the inherent difficulties that arise due to distributed-ness of computing resources. Identify the challenges in developing distributed applications

7

#### **414463: Ubiquitous Computing**

1. Demonstrate the knowledge of design of UbiComp and its applications.
2. Explain smart devices and services used UbiComp.
3. Describe the significance of actuators and controllers in real time application design.

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4. Use the concept of HCI to understand the design of automation applications.
  5. Classify Ubicomp privacy and explain the challenges associated with Ubicomp privacy.
- Get the knowledge of ubiquitous and service oriented networks along with Ubicompmanagement.

8 **414464A: Elective III**


**Internet of Things (IoT)**

1. Explain what is internet of things.
2. Explain architecture and design of IoT.
3. Describe the objects connected in IoT.
4. Understand the underlying Technologies.
5. Understand the platforms in IoT.
6. Understand cloud interface to IoT.


9 **414464D: Elective IV**

**Social Media Analytics**

1. Understand the basics of Social Media Analytics.
2. Explain the significance of Data mining in Social media.
3. Demonstrate the algorithms used for text mining.
4. Apply network measures for social media data.
5. Explain Behavior Analytics techniques used for social media data.
6. Apply social media analytics for Face book and Twitter kind of applications.

  
Head

Information Technology Department

  
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SECOND YEAR

Electronics & Telecommunication Engineering (2019 Course)

Course Objectives & Outcomes

Sr. No.	Name of the subject	Engineering Mathematics –III
1	Course Objectives 1	To make the students familiarize with concepts and techniques in Ordinary differential equations, Fourier Transform, Z-Transform, Numerical methods, Vector calculus and functions of a Complex variable.
	Course Objectives 2	The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines
	Course Outcomes 1	Solve higher order linear differential equation using appropriate techniques For modeling, analyzing of electrical circuits and control systems.
	Course Outcomes 2	Apply concept of Fourier transform & Z-transform and its applications to continuous & discrete systems, signal & image processing and Communication systems.
	Course Outcomes 3	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.
	Course Outcomes 4	Perform vector differentiation & integration, analyze the vector fields and Apply to electro- magnetic fields & wave theory.
	Course Outcomes 5	Analyze Complex functions, conformal mappings, Contour integration applicable to electrostatics, digital filters, signal and image processing
	2	Name of the subject
Course Objectives 1		Semiconductor device MOSFET, its characteristics, parameters & Applications.
Course Objectives 2		Concepts of feedbacks in amplifiers & oscillators
Course Objectives 3		Operational amplifier, concept, parameters & applications.
Course Objectives 4		ADC, DAC as an interface between analog & digital domains.
Course Objectives 5		Voltage to current and current to voltage converters.
Course Objectives 6		Concepts, characteristics & applications of PLL.
Course Outcomes 1	Assimilate the physics, characteristics and parameters of MOSFET towards its	

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		Application as amplifier.
	Course Outcomes 2	Design MOSFET amplifiers, with and without feedback, & MOSFET oscillators, for given specifications.
	Course Outcomes 3	Analyze and assess the performance of linear and switching regulators, with Their variants, towards applications in regulated power supplies.
	Course Outcomes 4	Explain internal schematic of Op-Amp and define its performance Parameters.
	Course Outcomes 5	Design, Build and test Op-amp based analog signal processing and Conditioning circuits towards various real time applications.
	Course Outcomes 6	Understand and compare the principles of various data conversion Techniques and PLL with their applications.
3	Name of the subject	Digital Circuits
	Course Objectives 1	The fundamental principles of two-valued logic and various devices used to Implement logical operations on variables.
	Course Objectives 2	Boolean algebra, Karnaugh maps and its application to the design and characterization of digital circuits
	Course Objectives 3	To analyze logic processes and implement logical operations using Combinational logic circuits.
	Course Objectives 4	The principles of logic design and use of simple memory devices, flip-flops, and sequential circuits
	Course Objectives 5	Concepts of sequential circuits and to analyze sequential systems in terms of state machines.
	Course Objectives 6	System design approach using programmable logic devices.
	Course Outcomes 1	Identify and prevent various hazards and timing problems in a digital design.
	Course Outcomes 2	Use the basic logic gates and various reduction techniques of digital logic Circuit.
	Course Outcomes 3	Analyze, design and implement combinational logic circuits.
	Course Outcomes 4	Analyze, design and implement sequential circuits.
	Course Outcomes 5	Differentiate between Mealy and Moore machines.
	Course Outcomes 6	Analyze digital system design using PLD.
4	Name of the Subject	Electrical Circuits
	Course Objectives 1	To analyze simple DC and AC circuits with circuit simplification techniques.
	Course Objectives 2	To formulate and analyze driven and source free RL and RC circuits.
	Course Objectives 3	To formulate & determine network parameters for given network.
	Course Objectives 4	To understand the constructional details, characteristics, features and Application areas of various types of electric motors.

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	Course Outcomes 1	Analyze the simple DC and AC circuit with circuit simplification techniques.
	Course Outcomes 2	Formulate and analyze driven and source free RL and RC circuits.
	Course Outcomes 3	Formulate & determine network parameters for given network and analyze The given network using Laplace Transform to find the network transfer function.
	Course Outcomes 4	Explain construction, working and applications of DC Machines / Single Phase & Three Phase AC Motors.
	Course Outcomes 5	Explain construction, working and applications of special purpose motors & Understand motors used in electrical vehicles.
	Course Outcomes 6	Analyze and select a suitable motor for different applications.
5	Name of the subject	Data Structures
	Course Objectives 1	To learn different sorting and searching algorithms and their analysis.
	Course Objectives 2	To learn linear data structures: Stack and Queue, Linked List and their Applications.
	Course Objectives 3	To learn nonlinear data structures: Tree, Graph and their applications.
	Course Objectives 4	To study the systematic ways of solving problem, various methods of Organizing large amount of data.
	Course Objectives 5	To solve problems using data structures such as binary tree, binary search tree, and graph and writing programs.
	Course Outcomes 1	Solve mathematical problems using C programming language.
	Course Outcomes 2	Implement sorting and searching algorithms and calculate their complexity.
	Course Outcomes 3	Develop applications of stack and queue using array.
	Course Outcomes 4	Demonstrate applicability of Linked List.
	Course Outcomes 5	Demonstrate applicability of nonlinear data structures - Binary Tree with Respect to its time complexity.
	Course Outcomes 6	Apply the knowledge of graph for solving the problems of spanning tree and Shortest path algorithm.
6	Name of the subject	Signals & Systems
	Course Objectives 1	To understand the mathematical representation of continuous and discrete Time signals and systems.
	Course Objectives 2	To classify signals and systems into different categories
	Course Objectives 3	To analyze Linear Time Invariant (LTI) systems in time and transform Domains.
	Course Objectives 4	To build basics for understanding of courses such as signal processing, Control system and communication.

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	Course Objectives 5	To develop basis of probability and random variables.
	Course Outcomes 1	Identify classify basic signals and perform operations on signals.
	Course Outcomes 2	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.
	Course Outcomes 3	Analyze and resolve the signals in frequency domain using Fourier series and Fourier Transform.
	Course Outcomes 4	Resolve the signals in complex frequency domain using Laplace Transform and will be able to apply and analyze the LTI systems using Laplace Transforms.
	Course Outcomes 5	Define and describe the probability, random variables and random signals. Compute the probability of a given event, model, compute the CDF and PDF.
	Course Outcomes 6	Compute the mean, mean square, variance and standard deviation for given Random variables using PDF.
7	Name of the subject	Control Systems
	Course Objectives 1	To Introduce elements of control system and their modeling using various Techniques
	Course Objectives 2	To get acquainted with the methods for analyzing the time response and Stability of System
	Course Objectives 3	To Introduce and analyze the frequency response and Stability of System
	Course Objectives 4	To Introduce concept of root locus, Bode plots, Nyquist plots.
	Course Objectives 5	To Introduce State Variable Analysis method.
	Course Objectives 6	To get acquainted with Concepts of PID controllers and IoT based Industrial Automation.
	Course Outcomes 1	Determine and use models of physical systems in forms suitable for use in The analysis and design of control systems.
	Course Outcomes 2	Determine the (absolute) stability of a closed-loop control system.
	Course Outcomes 3	Perform time domain analysis of control systems required for stability Analysis.
	Course Outcomes 4	Perform frequency domain analysis of control systems required for stability Analysis.
	Course Outcomes 5	Apply root-locus, Frequency Plots technique to analyze control systems.
	Course Outcomes 6	Express and solve system equations in state variable form.
	Course Outcome 7	Differentiate between various digital controllers and understand the role of The controllers in Industrial automation.

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8	Name of the subject	Principles of Communication Systems
	Course Objectives 1	To equip/ familiarize students with basic mathematical tools for time and Frequency domain analysis of communication signal and systems.
	Course Objectives 2	To acquaint the students with the fundamental principles of modulation Process and different amplitude and angle modulation systems.
	Course Objectives 3	To introduce the students with the concept of Sampling theorem and pulse Modulation techniques PAM, PWM, PPM.
	Course Objectives 4	To impart pre-requisites of digital communication systems and explore digital representation techniques like PCM, DPCM, DM and ADM.
	Course Objectives 5	To highlight the issues in baseband digital transmission such as data Representation, synchronization, multiplexing and ISI.
	Course Outcomes 1	To compute & compare the bandwidth and transmission power requirements by analyzing time and frequency domain spectra of signal Required for modulation schemes under study.
	Course Outcomes 2	Describe and analyze the techniques of generation, transmission and Reception of Amplitude Modulation Systems.
	Course Outcomes 3	Explain generation and detection of FM systems and compare with AM Systems.
	Course Outcomes 4	Exhibit the importance of Sampling Theorem and correlate with Pulse Modulation technique (PAM, PWM, and PPM).
	Course Outcomes 5	Characterize the quantization process and elaborate digital representation Techniques (PCM, DPCM, DM and ADM).
	Course Outcomes 6	Illustrate waveform coding, multiplexing and synchronization techniques and Articulate their importance in baseband digital transmission.
9	Name of the subject	Object Oriented Programming
	Course Objectives 1	Make the students familiar with basic concepts and techniques of object oriented programming in C++ To acquaint the students with the fundamental principles of modulation process and different amplitude and angle Modulation systems.
	Course Objectives 2	Develop an ability to write programs in C++ for problem solving.
	Course Outcomes 1	Describe the principles of object oriented programming.
	Course Outcomes 2	Apply the concepts of data encapsulation, inheritance in C++.
	Course Outcomes 3	Understand Operator overloading and friend functions in C++.
	Course Outcomes 4	Apply the concepts of classes, methods inheritance and polymorphism to Write programs C++.
	Course Outcomes 5	Apply Templates, Namespaces and Exception Handling concepts to write Programs in C++.
	Course Outcomes 6	Describe and use of File handling in C++.

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10	Name of the subject	Employability Skills Development
	Course Objectives 1	Develop good communication skills – both oral as well as written.
	Course Objectives 2	Encourage creative and critical thinking among students.
	Course Objectives 3	Nurture collaborative behavior to work efficiently in groups.
	Course Outcomes 1	Define personal and career goals using introspective skills and SWOC Assessment. Outline and evaluate short-term and long-term goals.
	Course Outcomes 2	Develop effective communication skills (listening, reading, writing, and speaking), self- management attributes, problem solving abilities and team Working & building capabilities in order to fetch employment opportunities and further succeed in the workplace.
	Course Outcomes 3	Be a part of a multi-cultural professional environment and work effectively by enhancing inter-personal relationships, conflict management and Leadership skills.
	Course Outcomes 4	Comprehend the importance of professional ethics, etiquettes & morals and Demonstrate sensitivity towards it throughout certified career.
	Course Outcomes 5	Develop practically deployable skill set involving critical thinking, effective Presentations and leadership qualities to hone the opportunities of employability and excel in the professional environment.
11	Name of the subject	Project Based Learning
	Course Objectives 1	To emphasize project based learning activities that are long-term, Interdisciplinary and student-centric.
	Course Objectives 2	To inculcate independent and group learning by solving real world problem With the help of available resources.
	Course Objectives 3	To be able to develop application based on the fundamentals of electronics and communication engineering by possibly the integration of previously Acquired knowledge.
	Course Objectives 4	To get practical experience in all steps in the life cycle of the development of Electronic systems: specification, design, implementation, and testing.
	Course Objectives 5	To be able to select and utilize appropriate hardware and software tools to Design and analyze the proposed system.
	Course Objectives 6	To provide every student the opportunity to get involved either individually Or as a group so as to develop team skills and learn professionalism.
	Course Outcomes 1	Identify the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aim and objectives.
	Course Outcomes 2	Contribute to society through proposed solution by strictly following Professional ethics and safety measures.
	Course Outcomes 3	Propose a suitable solution based on the fundamentals of electronics and

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		communication engineering by possibly the integration of previously Acquired knowledge.
Course Outcomes 4		Analyze the results and arrive at valid conclusion.
Course Outcomes 5		Use of technology in proposed work and demonstrate learning in oral and Written form.
Course Outcomes 6		Develop ability to work as an individual and as a team member.

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Head of the Department  
Electronics & Telecommunication Engineering



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THIRD YEAR

Electronics & Telecommunication Engineering (2019 Course)

Course Outcome and Course Objectives

Sr. No.	Name of the subject	Digital Communication
1	Course Objectives 1	To familiarize students with various digital modulation techniques used in Digital communication systems.
	Course Objectives 2	To equip students the students with tools required for performance analysis Of digital communication systems..
	Course Objectives 3	To introduce the students with the concept of information theory & coding techniques
	Course Outcomes 1	Apply the statistical theory for describing various signals in a communication System.
	Course Outcomes 2	Understand and explain various digital modulation techniques used in digital Communication systems and analyze their performance in presence of AWGN noise.
	Course Outcomes 3	Describe and analyze the digital communication system with spread Spectrum modulation...
	Course Outcomes 4	Analyze a communication system using information theoretic approach.
	Course Outcomes 5	Use error control coding techniques to improve performance of a digital communication system
2	Name of the subject	Electromagnetic Field Theory
	Course Objectives 1	Provide the foundation and rudiments of Electromagnetic theory essential to Subsequent courses of radiation, microwave and wireless communications.
	Course Objectives 2	Expose the students to basic laws of electro statics, magneto statics leading To the Maxwell Equations for static and dynamic fields.
	Course Objectives 3	Extend these laws to Uniform Plane waves, transmission line theory and Some of the case studies of applications of engineering electromagnetic field theory.
	Course Objectives 4	The main focus will be on the physical interpretation of all the mathematical formulations and extend these concepts to real time applications in the field Electronics and Telecommunication Engineering
Course Outcomes 1	Apply the basic electromagnetic principles and determine the fields (E & H) Due to the given source.	

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	Course Outcomes 2	Apply boundary conditions to the boundaries between various media to Interpret behavior of the fields on either side.
	Course Outcomes 3	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 Pointing Theorem, Retarded magnetic vector potential.
	Course Outcomes 4	Formulate, Interpret and solve simple uniform plane wave (Helmholtz Equations) equations, and analyze the incident/reflected/transmitted waves at normal incidence.
	Course Outcomes 5	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.
	Course Outcomes 6	Carry out a detailed study, interpret the relevance and applications of Electromagnetic
3	Name of the subject	Database Management
	Course Objectives 1	To understand fundamental concepts of database from its design to its Implementation.
	Course Objectives 2	To analyze database requirements and determine the entities involved in the System and with one another.
	Course Objectives 3	To manipulate database using SQL Query to create, update and manage Database.
	Course Objectives 4	Be familiar with the basic issues of transaction processing and concurrency Control.
	Course Objectives 5	To learn and understand Parallel Databases and its Architectures.
	Course Objectives 6	To learn and understand Distributed Databases and its applications.
	Course Outcomes 1	Ability to implement the underlying concepts of a database system.
	Course Outcomes 2	Design and implement a database schema for a given problem-domain using Data model.
	Course Outcomes 3	Formulate, using SQL/DML/DDDL commands, solutions to a wide range of Query and update problems.
	Course Outcomes 4	Implement transactions, concurrency control, and be able to do Database Recovery.
	Course Outcomes 5	Able to understand various Parallel Database Architectures and its applications
	Course Outcomes 6	Able to understand various Distributed Databases and its applications.

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4	Name of the Subject	Microcontroller
	Course Objectives 1	Understand architecture and features of 8051 and PIC18FXX Microcontroller.
	Course Objectives 2	Learn interfacing of real-world peripheral devices with microcontroller.
	Course Objectives 3	Explore different features of PIC 18F Microcontroller with Architecture
	Course Objectives 4	Use concepts of timers and interrupts of PIC 18 in programming.
	Course Objectives 5	Design and develop microcontroller based embedded application.
	Course Objectives 6	Demonstrate real life applications using PIC 18.
	Course Outcomes 1	Understand the fundamentals of microcontroller and programming.
	Course Outcomes 2	Interface various electronic components with microcontrollers.
	Course Outcomes 3	Analyze the features of PIC 18F XXXX.
	Course Outcomes 4	Describe the programming details in peripheral support.
	Course Outcomes 5	Develop interfacing models according to applications.
	Course Outcomes 6	Evaluate the serial communication details and interfaces
5	Name of the subject	Fundamentals of JAVA Programming (Elective -I)
	Course Objectives 1	Make the students familiar with basic concepts and techniques of object Oriented programming in Java.
	Course Objectives 2	Develop an ability to write various programs in Java for problem solving.
	Course Outcomes 1	Understand the basic principles of Java programming language
	Course Outcomes 2	Apply the concepts of classes and objects to write programs in Java
	Course Outcomes 3	Demonstrate the concepts of methods & Inheritance
	Course Outcomes 4	Use the concepts of interfaces & packages for program implementation
	Course Outcomes 5	Understand multithreading and Exception handling in Java to develop robust programs
	Course Outcomes 6	Use Graphics class, AWT packages and manage input and output files in Java
	6	Name of the subject
Course Objectives 1		Various propagation Model and Estimation techniques of wireless Communication system.
Course Objectives 2		OFDM and MIMO technologies to explain modern wireless systems.
Course Objectives 3		Various aspects of mobile communication system.
Course Objectives 4		Various aspects of wireless-system planning.
Course Objectives 5		Different Generation of Mobile Networks.
Course Objectives 6		Diversified issues that can enhance Network Performance.
Course Outcomes 1		Understand fundamentals of wireless communications.
Course Outcomes 2		Discuss and study OFDM and MIMO concepts.
Course Outcomes 3		Elaborate fundamentals mobile communication.
Course Outcomes 4		Describes aspects of wireless system planning.

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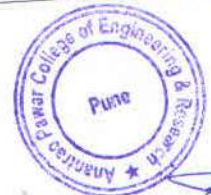
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	Course Outcomes 5	Understand of modern and futuristic wireless networks architecture.
	Course Outcomes 6	Summarize different issues in performance analysis.
7	Name of the subject	Project Management
	Course Objectives 1	The basics of project management and its life cycle
	Course Objectives 2	The process of project identification, selection criteria of the project and how the project planning is undertaken.
	Course Objectives 3	The organizational structure within a project and issues related to project management
	Course Objectives 4	The techniques for effective project scheduling and resource considerations in project.
	Course Objectives 5	The basics of effective handling the risks as well as managing finances within the project
	Course Objectives 6	The complete product development process and requirements for Entrepreneurship along with related legal issues.
	Course Outcomes 1	Apply the fundamental knowledge of project management for effectively Handling the projects.
	Course Outcomes 2	Identify and select the appropriate project based on feasibility study and Undertake its effective planning.
	Course Outcomes 3	Assimilate effectively within the organizational structure of project and Handle project management related issues in an efficient manner.
	Course Outcomes 4	Apply the project scheduling techniques to create a Project Schedule Plan And accordingly utilize the resources to meet the project deadline.
	Course Outcomes 5	Identify and assess the project risks and manage finances in line with Project Financial Management Process.
	Course Outcomes 6	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.
8	Name of the subject	Power Devices & Circuits
	Course Objectives 1	To introduce different power devices viz. SCR, GTO, MOSFET and IGBT with construction, characteristics, repetitive and non repetitive ratings and typical Triggering/driver circuits.
	Course Objectives 2	To understand working, design and performance analysis and applications of various power converter circuits such as ac to dc converters, inverter and chopper
	Course Objectives 3	To know various protection circuit requirements of power electronic devices.
	Course Outcomes 1	To differentiate based on the characteristic parameters among SCR, GTO, MOSFET & IGBT and identify suitability of the power device for certain

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	Course Outcomes 2	Applications and understand the significance of device ratings. To design triggering / driver circuits for various power devices.
	Course Outcomes 3	To evaluate and analyze various performance parameters of the different Converters and its topologies..
	Course Outcomes 4	To understand significance and design of various protections circuits for Power devices.
	Course Outcomes 5	To evaluate the performance of uninterruptible power supplies, switch mode power supplies and battery
	Course Outcomes 6	To understand case studies of power electronics in applications like electric vehicles, solar systems etc
9	Name of the subject	Advanced JAVA Programming (Elective -II)
	Course Objectives 1	Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.
	Course Objectives 2	Design and develop Web applications
	Course Objectives 3	Designing Enterprise based applications by encapsulating an application's Business logic..
	Course Objectives 4	Designing applications using pre-built frameworks
	Course Outcomes 1	Design and develop GUI applications using Applets.
	Course Outcomes 2	Apply relevant AWT/ swing components to handle the given event.
	Course Outcomes 3	Design and develop GUI applications using Abstract Windowing Toolkit (AWT), Swing and Event Handling.
	Course Outcomes 4	Learn to access database through Java programs, using Java Database Connectivity (JDBC)
	Course Outcomes 5	Invoke the remote methods in an application using Remote Method Invocation (RMI)
	Course Outcomes 6	Develop program for client /server communication using Java Networking Classes.
10	Name of the subject	Mini Project
	Course Objectives 1	To understand the "Product Development Process" including budgeting Through Mini Project.
	Course Objectives 2	To plan for various activities of the project and distribute the work amongst Team members.
	Course Objectives 3	To inculcate electronic hardware implementation skills by -
	Course Objectives 4	Learning PCB artwork design using an appropriate EDA tool.
	Course Objectives 5	Imbibing good soldering and effective trouble-shooting practices.
	Course Objectives 6	Following correct grounding and shielding practices.
	Course Objectives 7	To develop student's abilities to transmit technical information clearly and Test the same by delivery of Seminar based on the Mini Project.

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Course Objectives 8	To understand the importance of document design by compiling Technical Report on the Mini Project work carried out.
Course Outcomes 1	Understand, plan and execute a Mini Project with team.
Course Outcomes 2	Implement electronic hardware by learning PCB artwork design, soldering techniques, testing and troubleshooting etc.
Course Outcomes 3	Prepare a technical report based on the Mini project.
Course Outcomes 4	Deliver technical seminar based on the Mini Project work carried out.

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FOURTH YEAR

Electronics & Telecommunication Engineering (2019 Course)

Course Outcomes and Course Objectives

Sr. No	Name Of subject	Radiation and Microwave Theory
1	Course Objectives 1	To introduce fundamental theory of radiation and microwaves.
	Course Objectives 2	To understand theory of passive and active components of microwave systems.
	Course Objectives 3	To know the characteristics of various microwave solid state active devices.
	Course Objectives 4	To learn microwave measurement techniques.
	Course Outcomes 1	Apply the fundamentals of electromagnetic to derive free space propagation equation and distinguish various performance parameters of antenna.
	Course Outcomes 2	Identify various modes in the waveguide. Compare: coaxial line, rectangular waveguides & strip lines and identify applications of the same.
	Course Outcomes 3	Explore construction and working of principles passive microwave devices/components
	Course Outcomes 4	Explore construction and working of principles active microwave devices/components.
	Course Outcomes 5	Analyze the structure, characteristics, operation, equivalent circuits and applications of various microwave solid state active devices
	Course Outcomes 6	Know the various microwave systems, device set ups of microwave measurement devices and Identify the effect of radiations on environmental
2	Name Of subject	VLSI Design and Technology
	Course Objectives 1	To explore Hardware Description Language (HDL) and respective digital design methodologies.

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Course Objectives 2	To train the students for Complementary Metal Oxide Semiconductor (CMOS) circuit designs.	
Course Objectives 3	To realize importance of testability in logic circuit design	
Course Objectives 4	To overview an Application Specific Integrated Circuit (ASIC) issues and to understand Programmable Logic Devices (PLD) architectures with advanced features.	
Course Outcomes 1	Develop effective HDL codes for digital design.	
Course Outcomes 2	Apply knowledge of real time issues in digital design.	
Course Outcomes 3	Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.	
Course Outcomes 4	Design CMOS circuits for specified applications.	
Course Outcomes 5	Analyze various issues and constraints in design of an ASIC	
Course Outcomes 6	Apply knowledge of testability in design and Build In Self Test (BIST) circuit.	
3	Name Of subject	Cloud Computing
Course Objectives 1	To introduce the fundamentals of Cloud computing, its technologies, Challenges and Applications	
Course Objectives 2	To give Insights into the virtualization technologies and Architecture.	
Course Objectives 3	To know the relationship between Cloud and SOA.	
Course Objectives 4	To classify and evaluate Cloud Security Issues	
Course Objectives 5	To apply theory to practical knowledge through case Studies.	
Course Objectives 4	To classify and evaluate Cloud Security Issues	

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Course Outcomes 1	Understand the basic concepts of Cloud Computing.
Course Outcomes 2	Classify the types of Virtualization.
Course Outcomes 3	Examine the Cloud Architecture and understand the importance of Cloud Security
Course Outcomes 4	Develop applications on Cloud Platforms
Course Outcomes 5	Evaluate distributed computing and the Internet of Things

3	Name Of subject	Java Script (Elective - III)
	Course Objectives 1	To learn the syntax and semantics of Java script.
	Course Objectives 2	To understand the data types and variables in Java script.
	Course Objectives 3	To learn how functions and objects are used in Java script.
	Course Objectives 4	To learn how to use regular expressions in java script for handling various string operations.
	Course Objectives 5	To understand the concept of object models and event handling in java script programs.
	Course Objectives 6	To learn the use of java script for controlling Windows and form handling
	Course Outcomes 1	Use basic features of java script.
	Course Outcomes 2	Use relevant data types for developing application in java script.
	Course Outcomes 3	Use the function and objects as self-contained, with data passing in and out through well-defined interfaces in development of small systems.
	Course Outcomes 4	Apply the regular expression for Text matching and manipulation
	Course Outcomes 5	Explore use of the various aspects of JavaScript object models that are fundamental to the proper use of the language.
	Course Outcomes 6	Develop the application using windows controlling and form handling.

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4	Name Of Subject	Electronics Product Design (Elective - IV)
	Course Objectives 1	To understand the stages of product (hardware/ software) design and development.
	Course Objectives 2	To learn the different considerations of analog, digital and mixed circuit design.
	Course Objectives 3	To be acquainted with methods of PCB design and different tools used for PCB Design.
	Course Objectives 4	To understand the importance of testing in product design cycle.
	Course Objectives 5	To understand the processes and importance of documentation
	Course Outcomes 1	Understand and explain design flow of design of electronics product.
	Course Outcomes 2	Associate with various circuit design issues and testing
	Course Outcomes 3	Inferring different software designing aspects and the Importance of product test & test specifications.
	Course Outcomes 4	Summarizing printed circuit boards and different parameters.
	Course Outcomes 5	Estimating assorted product design aspects.
	Course Outcomes 6	Exemplifying special design considerations and importance of documentation.
5	Name Of Subject	Project Phase – I
	Course Objectives 1	To understands the basic concepts & broad principles of projects.
	Course Objectives 2	To understands the value of achieving perfection in project implementation & completion.
	Course Objectives 3	To applies the theoretical concepts to solve real life problems with teamwork and Multidisciplinary approach.
	Course Objectives 4	To demonstrates professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.
	Course Outcomes 1	Demonstrate a sound technical knowledge in field of E&TC in the form of project.

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Course Outcomes 2	Undertake real life problem identification, formulation and solution.
Course Outcomes 3	Design engineering solutions to complex problems utilizing a systematic approach.
Course Outcomes 4	Demonstrate the knowledge, effective communication skills and attitudes as professional engineer.

6	Name Of Subject	Fiber Optic Communication
	Course Objectives 1	To familiarize learners with various components & equipments used in fiber optic communication systems.
	Course Objectives 2	To study the impact of choice of components on system design
	Course Objectives 3	To introduce students to the WDM components and their role in capacity upgrade.
	Course Objectives 4	To extend the fundamentals to design and analysis of fiber optic communication links.
	Course Objectives 5	Expose students to the measurement standards, specifications and state of art developments in optical networks.

	Course Outcomes 1	Explain the working of components and measurement equipments in optical fiber networks.
	Course Outcomes 2	Calculate the important parameters associated with optical components used in fiber optic telecommunication systems.
	Course Outcomes 3	Compare and contrast the performance of major components in optical links.
	Course Outcomes 4	Evaluate the performance viability of optical links using the power and rise time budget analysis
	Course Outcomes 5	Design digital optical link by proper selection of components and check its viability using simulation tools

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7	Name Of Subject	Innovation and Entrepreneurship
	Course Objectives 1	To know innovation and entrepreneurship.
	Course Objectives 2	To be trained in design thinking.
	Course Objectives 3	To comprehend idea generation.
	Course Objectives 4	To gain knowledge of starting a venture.
	Course Objectives 5	To study about patents and patent filing.
	Course Objectives 6	To become skilled at digital marketing
	Course Outcomes 1	Understand Innovation, Entrepreneurship and characteristics of an entrepreneur.
	Course Outcomes 2	Develop a strong understanding of the Design Process and its application in variety of business settings.
	Course Outcomes 3	Generate sustainable ideas
	Course Outcomes 4	Explore various processes required to be an entrepreneur.
	Course Outcomes 5	Understand patents and its process of filing
	Course Outcomes 6	Choose and use appropriate social media for marketing
8	Name Of Subject	Digital Business Management
	Course Objectives 1	To familiarize with digital business concept.
	Course Objectives 2	To acquaint with E-commerce
	Course Objectives 3	To give insights into E-business and its strategies
	Course Outcomes 1	Identify drivers of digital business
	Course Outcomes 2	Illustrate various approaches and techniques for E-business and management.
	Course Outcomes 3	Prepare E-business plan.
9	Name Of Subject	Machine Learning
	Course Objectives 1	To understand the basic concepts machine Learning and apply different

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	dimensionality reduction techniques
Course Objectives 2	To optimize the different linear methods of regression and classification
Course Objectives 3	To interpret the different supervised classification methods of support vector machine and tree based models
Course Objectives 4	To learn the different models of neural network for solving non linear functions
Course Objectives 5	To acquire the knowledge of different generative models through unsupervised learning
Course Objectives 6	To explain the different graphical and Hidden Markov models of learning
Course Outcomes 1	Recognize the characteristics of machine learning that makes it useful to real world problems and apply different dimensionality reduction techniques.
Course Outcomes 2	Use different linear methods for regression and classification with their optimization through different regularization techniques.
Course Outcomes 3	Apply the different supervised learning methods of support vector machine and tree based models.
Course Outcomes 4	Select the appropriate type of neural network architecture and apply for learning non-linear functions.
Course Outcomes 5	Distinguish different generative models through unsupervised learning.



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**Savitribai Phule Pune University**

**Second Year of Artificial Intelligence and Data Science (2020 Course)**

**210241: Discrete Mathematics**

Course Outcomes:

On completion of the course, learner will be able to

CO1:Formulate problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly.

CO2:Apply appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations including those in real-life contexts.

CO3:Design and analyze real world engineering problems by applying set theory, propositional logic and to construct proofs using mathematical induction.

CO4:Specify, manipulate and apply equivalence relations; construct and use functions and apply these concepts to solve new problems.

CO5:Calculate numbers of possible outcomes using permutations and combinations; to model and analyze computational processes using combinatorics.

CO6:Model and solve computing problem using tree and graph and solve problems using appropriate algorithms.

CO7:Analyze the properties of binary operations, apply abstract algebra in coding theory and evaluate the algebraic structures.

**210242: Fundamentals of Data Structures**

Course Outcomes:

On completion of the course, learner will be able to

CO1:Design the algorithms to solve the programming problems, identify appropriate algorithmic strategy for specific application, and analyze the time and space complexity.



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CO2:Discriminate the usage of various structures, Design/Program/Implement the appropriate data structures; use them in implementations of abstract data types and Identity the appropriate data structure in approaching the problem solution.

CO3:Demonstrate use of sequential data structures- Array and Linked lists to store and process data.

CO4:Understand the computational efficiency of the principal algorithms for searching and sorting and choose the most efficient one for the application.

CO5:Compare and contrast different implementations of data structures (dynamic and static).

CO6:Understand, Implement and apply principles of data structures-stack and queue to solve computational problems.

#### **210243: Object Oriented Programming(OOP)**

Course Outcomes:

On completion of the course, learner will be able to

CO1: Apply constructs- sequence, selection and iteration; classes and objects, inheritance, use of predefined classes from libraries while developing software.

CO2: Design object-oriented solutions for small systems involving multiple objects.

CO3: Use virtual and pure virtual function and complex programming situations.

CO4: Apply object-oriented software principles in problem solving.

CO5: Analyze the strengths of object-oriented programming.

CO6: Develop the application using object oriented programming language(C++).

#### **210244: Computer Graphics**

Course Outcomes:

On completion of the course, learner will be able to

CO1:Identify the basic terminologies of Computer Graphics and interpret the mathematical

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foundation of the concepts of computer graphics.

CO2: Apply mathematics to develop Computer programs for elementary graphic operations.

CO3: Illustrate the concepts of windowing and clipping and apply various algorithms to fill and clip polygons.

CO4: Understand and apply the core concepts of computer graphics, including transformation in two and three dimensions, viewing and projection.

CO5: Understand the concepts of color models, lighting, shading models and hidden surface elimination.

CO6: Create effective programs using concepts of curves, fractals, animation and gaming

#### **217521: Operating Systems**

Course Outcomes:

On completion of the course, learner will be able to

CO1: Enlist functions of OS and types of system calls

CO2: Apply process scheduling algorithms to solve a given problem

CO3: Illustrate deadlock prevention, avoidance and recovery

CO4: Explain memory management technique

CO5: Illustrate I/O and file management policies

CO6: Describe Linux process management

#### **217522: Data Structures Laboratory Course Outcomes:**

On completion of the course, learner will be able to

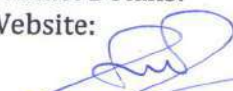
CO1: Use algorithms on various linear data structure using sequential organization to solve real life problems.

CO2: Analyze problems to apply suitable searching and sorting algorithm to various applications.


CO3: Analyze problems to use variants of linked list and solve various real life problems.



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CO4: Designing and implement data structures and algorithms for solving different kinds of Problems

**217523: OOP and Computer Graphics Laboratory**

Course Outcomes:

On completion of the course, learner will be able to

CO1: Understand and apply the concepts like inheritance, polymorphism, exception handling and generic structures for implementing reusable programming codes.

CO2: Analyze the concept of file and apply it while storing and retrieving the data from secondary storages.

CO3: Analyze and apply computer graphics algorithms for line-circle drawing, scan conversion and filling with the help of object oriented programming concepts.

CO4: Understand the concept of windowing and clipping and apply various algorithms to fill and clip polygons.

CO5: Apply logic to implement, curves, fractals, animation and gaming programs.

**217524: Operating Systems Laboratory**

Course Outcomes:

On completion of the course, learner will be able to

CO1: Choose the best CPU scheduling algorithm for a given problem instance

CO2: Demonstrate interprocess communication

CO3: Apply deadlock avoidance algorithm

CO4: Compare performance of page replacement algorithms


CO5: Demonstrate the fundamental UNIX commands & system calls

**217525: Business Communication Skills Course Outcomes:**


On completion of the course, learner will be able to



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CO1: Express effectively through verbal/oral communication and improve listening skills

CO2: Write precise briefs or reports and technical documents.

CO3: Prepare for group discussion / meetings / interviews and presentations.

CO4: Explore goal/target setting, self-motivation and practicing creative thinking.

CO5: Operate effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership qualities.

**217526: Humanity and Social Science Course Outcomes:**

On completion of the course, learner will be

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

**217527-I: Green Construction and Design**

Course Outcomes:

On completion of the course, learner will be able to

CO1: Understand the importance of environment friendly society.

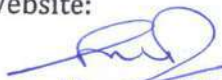
CO2: Apply primary measures to reduce carbon emissions from their surroundings.

CO3: Learn role of IT solutions in design of green buildings.

CO4: Understand the use of software systems to complete statutory compliances involved in the

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design of a new home or office building through green construction.

**217527-II: Social Awareness and Governance Program**

Course Outcomes:

On completion of the course, learner will be able to

CO1: Understand social issues and responsibilities as member of society.

CO2: Apply social values and ethics in decision making at social or organizational level

CO3: Promote obstacles in national integration and role of youth for National Integration

CO4: Demonstrate basic features of Indian Constitution.

**217527-IV: Smart Cities Course Objectives**

To identify urban problems

To study Effective and feasible ways to coordinate urban technologies.

To study models and methods for effective implementation of Smart Cities.

To study new technologies for Communication and Dissemination.

To study new forms of Urban Governance and Organization.

**217527-V: Foreign Language- Japanese (Module 1)**

On completion of the course learner will able to CO1: Will have ability of basic communication.

CO2: Will have the knowledge of Japanese script.

CO3: Will get introduced to reading , writing and listening skills

CO4: Will develop interest to pursue professional Japanese Language course.

**217528 : Statistics**

Course Outcomes:

On completion of the course, learner will be able to

CO1: Identify the use of appropriate statistical terms to describe data

CO2: Use appropriate statistical methods to collect, organize, display, and analyze relevant

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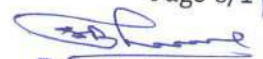
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data.

CO3: Use distribution functions for random variables

CO4: Distinguish between correlation coefficient and regression

CO5: Understand tests for hypothesis and its significance

**217529: Internet of Things**

Course Outcomes:

On completion of the course, learner will be able to

CO1: Have a thorough understanding of the structure, function and characteristics of computer systems and Understand the structure of various number systems and its application in digital design.

CO2: Develop the skill set to build IoT systems and sensor interfacing.

CO3: Explain the concept of Internet of Things and identify the technologies that make up the internet of things

CO4: Analyze trade-offs in interconnected wireless embedded device networks. Select Appropriate Protocols for IoT Solutions

CO5: Design a simple IoT system comprising sensors by analyzing the requirements of IoT Application

CO6: Identify the Application of IoT in automation of Commercial and Real World examples

**210252: Data Structures and Algorithms**

Course Outcomes:

On completion of the course, learner will be able to

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.

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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

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 the secondary storage.

### 210253: Software Engineering

Course Outcomes:

On completion of the course, learner will be able to 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 novelistic 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

### 217530: Management Information Systems

On completion of the course, learner will be able to

CO1 : Explain the concepts of Management Information System and Business intelligence for MIS.

CO2 : Illustrate the need of information systems in global business and ethical issues.

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CO3 : List the IT infrastructure components and explain security in the Information System.

CO4 : Demonstrate the importance of project management and extend its use in the international information system.

CO5 : Illustrate the concepts of decision support systems for business applications.

CO6 : Relate artificial intelligence and data science for Management Information System

217531: Internet of Things Laboratory

**217532: Data Structures and Algorithms Laboratory**

On completion of the course, learner will be able to

CO1: Understand the ADT/libraries, hash tables and dictionary to design algorithms for a specific problem.

CO2: Choose most appropriate data structures and apply algorithms for graphical solutions of the problems.

CO3: Apply and analyze non linear data structures to solve real world complex problems.

CO4: Apply and analyze algorithm design techniques for indexing, sorting, multi-way searching, file organization and compression.

CO5: Analyze the efficiency of most appropriate data structure for creating efficient solutions for engineering design situations

**217533: Project Based Learning II**

CO1: Identify the real life problem from societal need point of view

CO2: Choose and compare alternative approaches to select most feasible one


CO3: Analyze and synthesize the identified problem from technological perspective

CO4: Design the reliable and scalable solution to meet challenges

CO5: Evaluate the solution based on the criteria specified



CO6: Inculcate long life learning attitude towards the societal problems

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**217534: Code of Conduct**

To promote ethics, honesty and professionalism. To set standards that are expected to follow and to be aware that if one acts unethically what are the consequences.

To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues

To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis

To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.

**217535: Audit Course 4**

On completion of the course, learner will be able to

CO1: Understand the global water cycle and its various processes

CO2: Understand climate change and their effects on water systems

CO3: Understand Drinking treatment and quality of groundwater and surface water

CO4: Understand the Physical, chemical, and biological processes involved in water treatment and distribution

**217535-II: Intellectual Property Rights and PatCourse Outcomes:**

On completion of the course, learner will be able to

CO1: Understand the fundamental legal principles related to confidential information, copyright, patents, designs, trademarks and unfair competition

CO2: Identify, apply and assess principles of law relating to each of these areas of intellectual property

CO3: Apply the appropriate ownership rules to intellectual property you have been involved



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**217535-III: The Science of Happiness**

**On completion of the course, learner will be able to**

CO1: Understand what happiness is and why it matters to you

CO2: Learn how to increase your own happiness

CO3: Understand of the power of social connections and the science of empathy

CO4: Understand what is mindfulness and its real world applications

**217535-IV: Yoga and Meditation**

**On completion of the course, learner will be able to**

CO1: Understand philosophy and religion as well as daily life issues will be challenged and enhanced.

CO2: Enhances the immune system.

CO3: Intellectual and philosophical understanding of the theory of yoga and basic related Hindu scriptures will be developed.

CO4: Powers of concentration, focus, and awareness will be heightened.

**217535-V: Foreign Language ( Japanese) Module 2**

On completion of the course learner will1. have ability of basic communication.

2. have the knowledge of Japanese script.

3. get introduced to reading , writing and listening skills

4. develop interest to pursue professional Japanese Language course.

Date: 31/1/2023



Prof. Sneha S. Salvekar

Head, AI&DS Department




Dr. Sunil B. Thakar

APCOER, Pune

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**Course Outcomes [CO'S]**

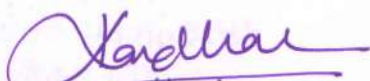
**CLASS: SECOND YEAR [2019 COURSE]**

**SUBJECT/CODE: Solid Mechanics [202041]**

1. To acquire basic knowledge of stress, strain due to various types of loading.
2. To draw Shear Force and Bending Moment Diagram for transverse loading.
3. To determine Bending, Shear stress, Slope and Deflection on Beam.
4. To solve problems of Torsional shear stress for shaft and Buckling for the column.
5. To apply the concept of Principal Stresses and Theories of Failure.
6. To utilize the concepts of Solid Mechanics on application based combined mode of loading.

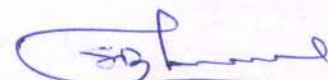
**SUBJECT/CODE: Solid Modeling and Drafting [202042]**

1. To understand basic structure of CAD systems and their use to create geometric models of simple engineering parts.
2. To introduce the curves and surfaces and their implement in geometric modeling.
3. To apply basic concepts of 3D modeling, viewing and evaluate mass properties of components and assemblies.
4. To apply geometrical transformations in CAD models.
5. To understand data exchange standards and translators for various applications.
6. To create engineering drawings, design documentation and use in manufacturing activities.

  
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## **SUBJECT/CODE: Engineering Thermodynamics [202043]**

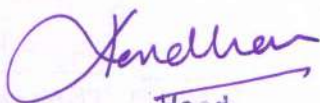
1. To introduce the fundamentals of thermodynamics.
2. To understand the concepts of laws of thermodynamics.
3. To apply the concepts of thermodynamics towards open and closed systems.
4. To be acquainted with Entropy generation and Exergy Analysis.
5. To understand the behaviour of a Pure substance and to analyze Vapour power cycles.
6. To undertake the performance analysis of a steam generator.

## **SUBJECT/CODE: Engineering Materials and Metallurgy [202044]**

1. To impart fundamental knowledge of material science and engineering.
2. To establish significance of structure property relationship.
3. To explain various characterization techniques.
4. To indicate the importance of heat treatment on structure and properties of materials.
5. To explain the material selection process.


## **SUBJECT/CODE: Electrical and Electronics Engineering [203156]**

1. To understand Arduino IDE; an open source platform and its basic programming features.
2. To interface Atmega328 based Arduino board with different devices and sensors.
3. To study principle of operation of DC machines and speed control of DC motors.
4. To know about three phase induction motor working and its applications.
5. To get acquainted with Electric Vehicle (EV) technology and subsystems.
6. To get familiar with various energy storage devices and electrical drives.



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**SUBJECT/CODE: Geometric Dimensioning and Tolerancing Lab**

**[202045]**

1. To understand requirements of industrial drawings.
2. To read, understand and explain basic Geometric Dimensioning & Tolerancing concepts.
3. To apply various geometric and dimension tolerances based on type of fit.
4. To include surface roughness symbols based on manufacturing process.
5. To measure and verify position tolerances with applied material conditions.
6. To understand requirements for manufacturing and assembly.

**SUBJECT/CODE: Engineering Mathematics - III [307002]**

1. To make the students familiarize with concepts and techniques in Ordinary & Partial differential equations, Laplace transform & Fourier transform, Statistical methods, Probability theory and Vector calculus.
2. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

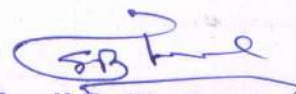
**SUBJECT/CODE: Kinematics of Machinery [202047]**

1. To make the students conversant with kinematic analysis of mechanisms applied to real life and industrial applications.
2. To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach.
3. To develop the skill to propose and synthesize the mechanisms using graphical and analytical technique.
4. To develop the competency to understand & apply the principles of gear theory to design various applications.
5. To develop the competency to design a cam profile for various follower motions.

  
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## **SUBJECT/CODE: Applied Thermodynamics [202048]**

1. To determine COP of refrigeration cycle and study Psychrometric properties and processes.
2. To study working of engine, Actual, Fuel-Air and Air standard cycle and its Performance.
3. To understand Combustion in SI and CI engines and factors affecting performance parameters.
4. To study emission from IC Engines and its controlling method, various emission norms.
5. To estimate performance parameters by conducting a test on I. C. Engines.
6. To determine performance parameters of Positive displacement compressor.

## **SUBJECT/CODE: Fluid Mechanics [202049]**

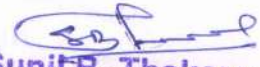
1. To understand basic properties of fluids.
2. To learn fluid statics and dynamics.
3. To study basics of flow visualization.
4. To understand Bernoulli's theorem and its applications.
5. To understand losses in flow, drag and lift forces
6. To learn to establish relation between flow parameters.

## **SUBJECT/CODE: Manufacturing Processes [202050]**

1. Describe various sand and permanent mould casting methods, procedure and mould design aspects.
2. Understand basics of metal forming processes, equipment and tooling.
3. Understand sheet metal forming operations and die design procedure.
4. Classify, describe and configure the principles of various welding techniques.
5. Understand plastic processing techniques.
6. To know about composites, its fabrication processes.

  
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## **SUBJECT/CODE: Machine Shop [202051]**

1. To understand the basic procedures, types of equipment, tooling used for sand casting and metal forming processes through demonstrations and/(or) Industry visits.
2. To understand TIG/ MIG/ Resistance/Gas welding welding techniques.
3. To acquire skills to handle grinding and milling machine and to produce gear by milling.
4. To acquire skills to produce a composite part by manual process.

## **SUBJECT/CODE: Project Based Learning - II [202052]**

1. To emphasize project based learning activities that are long-term, interdisciplinary and student-centric.
2. To inculcate independent and group learning by solving real world problems with the help of available resources.
3. To be able to develop applications based on the fundamentals of mechanical engineering by possibly applying previously acquired knowledge.
4. To get practical experience in all steps in the life cycle of the development of mechanical systems: specification, design, implementation, and testing.
5. To be able to select and utilize appropriate concepts of mechanical engineering to design and analyze selected mechanical system.

  
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## Department of Mechanical Engineering

### Course Outcomes [CO'S]

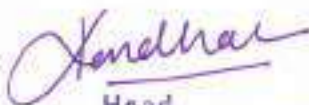
**CLASS: THIRD YEAR [2019 COURSE]**

**SUBJECT/CODE: Numerical and Statistical Methods [302041]**

1. SOLVE system of equations using direct and iterative numerical methods.
2. ESTIMATE solutions for differential equations using numerical techniques.
3. DEVELOP solution for engineering applications with numerical integration.
4. DESIGN and CREATE a model using a curve fitting and regression analysis.
5. APPLY statistical Technique for quantitative data analysis.
6. DEMONSTRATE the data, using the concepts of probability and linear algebra.

**SUBJECT/CODE: Heat and Mass Transfer [302042]**

1. ANALYZE & APPLY the modes of heat transfer equations for one dimensional thermal system.
2. DESIGN a thermal system considering fins, thermal insulation and & Transient heat conduction.
3. EVALUATE the heat transfer rate in natural and forced convection & validate with experimentation results.
4. INTERPRET heat transfer by radiation between objects with simple geometries, for black and grey surfaces.
5. ABILITY to analyze the rate of mass transfer using Fick's Law of Diffusion and understands mass diffusion in different coordinate systems.
6. DESIGN & ANALYSIS of heat transfer equipments and investigation of its performance.



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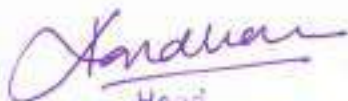
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## **SUBJECT/CODE: Design of Machine Elements [302043]**

1. DESIGN AND ANALYZE the cotter and knuckle Joints, levers and components subjected to eccentric loading.
2. DESIGN shafts, keys and couplings under static loading conditions.
3. ANALYZE different stresses in power screws and APPLY those in the procedure to design screw jack.
4. EVALUATE dimensions of machine components under fluctuating loads.
5. EVALUATE & INTERPRET the stress developed on the different type of welded and threaded joints.
6. APPLY the design and development procedure for different types of springs.


## **SUBJECT/CODE: Mechatronics [302044]**

1. DEFINE key elements of mechatronics, principle of sensor and its characteristics.
2. UTILIZE concept of signal processing and MAKE use of interfacing systems such as ADC, DAC, Digital I/O.
3. DETERMINE the transfer function by using block diagram reduction technique.
4. EVALUATE Poles and Zero, frequency domain parameter for mathematical modeling for mechanical system.
5. APPLY the concept of different controller modes to an industrial application.
6. DEVELOP the ladder programming for industrial application.



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## **SUBJECT/CODE: Advanced Forming & Joining Processes [302045-A]**

1. ANALYSE the effect of friction in metal forming deep drawing and IDENTIFICATION of surface defects and their remedies in deep drawing operations.
2. ASSESS the parameters for special forming operation and SELECT appropriate special forming operation for particular applications.
3. ANALYSE the effect of HAZ on microstructure and mechanical properties of materials.
4. CLASSIFY various solid state welding process and SELECT suitable welding processes for particular applications.
5. CO5. CLASSIFY various advanced welding process and SELECT suitable welding processes for particular applications.
6. INTERPRET the principles of sustainable manufacturing and its role in manufacturing industry.

## **SUBJECT/CODE: Machining Science & Technology [302045-B]**

1. DEFINE metal cutting principles and mechanics of metal cutting and tool life.
2. DESCRIBE features of gear and thread manufacturing processes.
3. SELECT appropriate grinding wheel and demonstrate the various surface finishing processes.
4. SELECT appropriate jigs/fixtures and to draw the process plan for a given component.
5. SELECT & EVALUATE various parameters of process planning.
6. GENERATE CNC program for Turning / Milling processes and generate tool path using CAM software.



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## **SUBJECT/CODE: Digital Manufacturing Laboratory [302046]**

1. DEVELOP a component using conventional machines, CNC machines and Additive Manufacturing Techniques.
2. ANALYZE cutting tool parameters for machining given job.
3. DEMONSTRATE simulation of manufacturing process using Digital Manufacturing Tools.
4. SELECT and DESIGN jigs and Fixtures for a given component.
5. DEMONSTRATE different parameters for CNC retrofitting and reconditioning.

## **SUBJECT/CODE: Skill Development [302047]**

1. APPLY & DEMONSTRATE procedure of assembly & disassembly of various machines.
2. DESIGN & DEVELOP a working/model of machine parts or any new product.
3. EVALUATE fault with diagnosis on the machines, machine tools and home appliances.
4. IDENTIFY & DEMONSTRATE the various activities performed in an industry such as maintenance, design of components, material selection.

## **SUBJECT/CODE: Artificial Intelligence & Machine Learning [302049]**

1. DEMONSTRATE fundamentals of artificial intelligence and machine learning.
2. APPLY feature extraction and selection techniques.
3. APPLY machine learning algorithms for classification and regression problems.
4. DEVISE AND DEVELOP a machine learning model using various steps.
5. EXPLAIN concepts of reinforced and deep learning.
6. SIMULATE machine learning model in mechanical engineering problems.

  
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## **SUBJECT/CODE: Computer Aided Engineering [202050]**

1. DEFINE the use of CAE tools and DESCRIBE the significance of shape functions in finite element formulations.
2. APPLY the various meshing techniques for better evaluation of approximate results.
3. APPLY material properties and boundary condition to SOLVE 1-D and 2-D element stiffness matrices to obtain nodal or elemental solution.
4. ANALYZE and APPLY various numerical methods for different types of analysis.
5. EVALUATE and SOLVE non-linear and dynamic analysis problems by analyzing the results obtained from analytical and computational method.
6. GENERATE the results in the form of contour plot by the USE of CAE tools.

## **SUBJECT/CODE: Design of Transmission Systems [202051]**

1. APPLY the principle of Spur & Helical gear design for industrial application and PREPARE a manufacturing drawing with the concepts of GD&T.
2. EXPLAIN and DESIGN Bevel & Worm gear considering design parameters as per design standards.
3. SELECT&DESIGN Rolling and Sliding Contact Bearings from manufacturer's catalogue for a typical application considering suitable design parameters.
4. DEFINE and DESIGN various types of Clutches, Brakes, used in automobile.
5. APPLY various concept to DESIGN Machine Tool Gear box, for different applications
6. ELABORATE various modes of operation, degree of hybridization and allied terms associated with hybrid electric vehicles.

  
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## **SUBJECT/CODE: Composite Materials [302052-A]**

1. DEFINE & COMPARE composites with traditional materials.
2. IDENTIFY & ESTIMATE different parameters of the Polymer Matrix Composite
3. CATEGORISE and APPLY Metal Matrix Process from possessions landscape.
4. DETERMINE volume/weight fraction and strength of Composites.
5. SELECT appropriate testing and inspection method for composite materials.
6. SELECT composites materials for various applications.

## **SUBJECT/CODE: Surface Engineering [302052-B]**

1. DEFINE the basic's principle & mechanism of surface degradation.
2. ANALYSE & SELECT correct corrosion prevention techniques for a different service condition.
3. DEMONSTRATE the role of surface engineering of materials to modify/improve the surface properties.
4. SELECT the suitable surface heat treatments to improve the surface properties.
5. APPLY the surface modification technique to modify surface properties.
6. ANALYSE & EVALUTE various surface coating defects using various testing/characterization method.

  
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## SUBJECT/CODE: Measurement Laboratory [302053]

1. 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.
2. ANALYZE strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.
3. 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.
4. MEASURE the dimensional accuracy using Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to reduce measurement lead time.
5. 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 entrepreneurships/business in various sectors of metrology like calibrations, testing, coordinate and laser metrology etc in an industry visit report.

  
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Dr. Sunil B. Thakare  
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## Department of Mechanical Engineering

### Course Outcomes [CO'S]

**CLASS: FINAL YEAR [2019 COURSE]**

**SUBJECT/CODE: Heating, Ventilation, Air Conditioning and Refrigeration [402041]**

1. ANALYSE different air-craft refrigeration systems and EXPLAIN the properties, applications and environmental issues of different refrigerants.
2. ANALYSE multi pressure refrigeration system used for refrigeration applications.
3. DISCUSS types of compressors, condensers, evaporators and expansion valves along with regulatory and safety controls and DESCRIBES Transcritical and ejector refrigeration systems.
4. ESTIMATE cooling load for air conditioning systems used with concern of design conditions and indoor quality of air.
5. DESIGN air distribution system along with consideration of ventilation and infiltration.
6. EXPLAIN the working of types of desiccants, evaporative, thermal storage, radiant cooling, clean room and heat pump systems.

**SUBJECT/CODE: Dynamics of Machinery [402042]**

1. APPLY balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.
2. ANALYZE the gyroscopic couple or effect for stabilization of Ship, Airplane and Four wheeler vehicles.
3. ESTIMATE natural frequency for single DOF un-damped & damped free vibratory systems.
4. DETERMINE response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.
5. ESTIMATE natural frequencies, mode shapes for 2 DOF un-damped free longitudinal and torsional vibratory systems.
6. DESCRIBE noise and vibration measuring instruments for industrial / real life applications along with suitable method for noise and vibration control.

  
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## **SUBJECT/CODE: Turbomachinery [402043]**

1. VALIDATE impulse moment principle using flat, inclined and curved surfaces and
2. INVESTIGATE performance characteristics of hydraulic turbines.
3. DETERMINE performance parameters of impulse and reaction steam turbine along with discussion of nozzles, governing mechanism & losses.
4. MEASURE performance parameters of single & multistage centrifugal pumps along with discussion of cavitation and selection.
5. EXPLAIN performance parameters of centrifugal compressor along with discussion of theoretical aspects of axial compressor.

## **SUBJECT/CODE: Automobile Design [402044 A]**

1. DESIGN of Principal Engine Components.
2. DESIGN of Drive train.
3. DESIGN of brakes and Suspension.

## **SUBJECT/CODE: Design of Heat Transfer Equipment's [402042-B]**

1. EXPLAIN the design aspect of heat exchanger considering fouling factor for Heat Transfer Applications.
2. SELECT and DESIGN the double tube heat exchangers for process industry.
3. DESIGN the Shell & Tube Heat Exchangers for specified conditions.
4. DESIGN the condensers and evaporators for refrigeration applications.
5. DESIGN the compact heat exchangers.
6. ANALYSE the performance of counter and cross flow cooling tower.

  
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## **SUBJECT/CODE: - Modern Machining Processes [402044-C]**

1. UNDERSTAND and ANALYZE the mechanism, process parameters of mechanical assisted modern machining processes.
2. UNDERSTAND the mechanism, construction and working of laser, plasma and electron beam assisted machining.
3. CLASSIFY and ANALYZE the mechanism, process parameters of the chemical and electrochemical machining.
4. RELATE and ANALYZE the mechanism and select process parameters Electrical Discharge Machining for an application.
5. ILLUSTRATE the application of micromachining processes.
6. SUGGEST appropriate nanomachining process for the specific application.

## **SUBJECT/CODE: Industrial Engineering [402044-D]**

1. CO1. EVALUATE the productivity and IMPLEMENT various productivity improvement techniques.
2. APPLY work study techniques and UNDERSTANDS its importance for better productivity.
3. DEMONSTRATE the ability to SELECT plant location, appropriate layout and material handling equipment.
4. USE of Production planning and control tools for effective planning, scheduling and managing the shop floor control.
5. PLAN inventory requirements and EXERCISE effective control on manufacturing requirements.
6. APPLY Ergonomics and legislations for human comfort at work place and UNDERSTANDS the role of value engineering in improving productivity.

  
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## **SUBJECT/CODE: Internet of Things [402044-E]**

1. EXPLAIN the Applications/Devices, Protocols and Communication Models of IoT.
2. DEMONSTRATE small Mechanical Engineering IoT oriented applications using Sensors, Actuators, Microcontrollers and Cloud.
3. SELECT commonly used IoT Simulation Hardware platforms.
4. APPLICATION of Interfacing and Communication Technologies for IoT.
5. ILLUSTRATE IoT Application Development and Security of IoT Ecosystem.
6. EVALUATE Present and Future Domain specific Applications of IoT Ecosystem.

## **SUBJECT/CODE: Computational Fluid Dynamics [402044-F]**

1. DISTINGUISH and ANALYSE the governing equations of fluid mechanics and heat transfer in various formulations.
2. ANALYZE and MODEL the conduction and advection problems.
3. ANALYZE and MODEL the Convection-Diffusion problems.
4. IDENTIFY and EVALUATE the External/Internal flow and its simulation.
5. DISTINGUISH and COMPARE concepts of stability and turbulence.
6. USE and APPLY a CFD tool for effectively solving practical Fluid-Structure Interaction Problems.

## **SUBJECT/CODE: Product Design and Development [40245A]**

1. UNDERSTAND Product design and Product development processes.
2. UNDERSTAND Processes, tools and techniques for Market Survey & Product Specification Finalization.
3. UNDERSTAND Processes, tools and techniques for Concept Inception, Verification and selection.
4. UNDERSTAND Processes, tools and techniques for Concept Exploration & Development.
5. UNDERSTAND Processes, tools and techniques for Design Verification and Validation.
6. UNDERSTAND Processes, tools and techniques for Robust Design and Development.

  
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**SUBJECT/CODE: Experimental Methods in Thermal Engineering  
[402045-B]**

1. IDENTIFY the suitable instrument for measuring parameters as per performance characteristics.
2. ANALYZE experimental data by using different statistical techniques and estimate error.
3. CO3. DISTINGUISH different methods of temperature measurements and thermal radiation.
4. CLASSIFY various pressure measurement instruments and their comparison.
5. EXPLAIN different flow measurement methods and flow visualization techniques.
6. APPLY knowledge of modern engineering experimentation, including calibration, data acquisition, analysis and interpretation using different AI and ML techniques.

**SUBJECT/CODE: Additive Manufacturing [402045-C]**

1. CO1. USE and CLASSIFY the fundamentals of Additive Manufacturing Technologies for engineering applications.
2. IDENTIFY and CATEGORIZE the methodology to manufacture the products using light-based photo-curing, LASER based technologies and STUDY their applications, benefits.
3. IDENTIFY and CATEGORIZE the methodology to manufacture the products using extrusion-based deposition, inkjet-based technologies and STUDY their applications, benefits.
4. SYNTHESIZE, RECOMMEND and DESIGN the suitable material and process for fabrication and build behavior of varieties of product.
5. DESIGN and CONSTRUCT the AM equipment's for appropriate applications and the input CAD model.
6. DEVELOP the knowledge of additive manufacturing for various real-life applications.

  
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## **SUBJECT/CODE: Operations Research [402045-D]**

1. EVALUATE various situations of Games theory and Decision techniques and
2. APPLY them to solve them in real life for decision making.
3. SELECT appropriate model for queuing situations and sequencing situations and
4. FIND the optimal solutions using models for different situations.
5. FORMULATE various management problems and SOLVE them using Linear programming using graphical method and simplex method.
6. FORMULATE variety of problems such as transportation, assignment, travelling salesman and SOLVE these problems using linear programming approach.
7. 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.
8. APPLY concepts of simulation and Dynamic programming.

## **SUBJECT/CODE: Augmented Reality and Virtual Reality [402045-E]**

1. UNDERSTAND fundamental Computer Vision, Computer Graphics and Human-Computer Interaction Techniques related to VR/AR.
2. UNDERSTAND Geometric Modeling Techniques.
3. UNDERSTAND the Virtual Environment.
4. ANALYZE and EVALUATE VR/AR Technologies.
5. APPLY various types of Hardware and Software in Virtual Reality systems.
6. DESIGN and FORMULATE Virtual/Augmented Reality Applications.

  
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## **SUBJECT/CODE: Data Analytics Laboratory [402046]**

1. UNDERSTAND the basics of data analytics using concepts of statistics and probability.
2. APPLY various inferential statistical analysis techniques to describe data sets and withdraw useful conclusions from acquired data set.
3. EXPLORE the data analytics techniques using various tools.
4. APPLY data science concept and methods to solve problems in real world context.
5. SELECT advanced techniques to conduct thorough and insightful analysis and interpret the results.

## **SUBJECT/CODE: Project (Stage I) [402047]**

1. Implement systems approach.
2. To conceptualize a novel idea / technique into a product.
3. To think in terms of a multi-disciplinary environment.
4. To take on the challenges of teamwork, and document all aspects of design work.
5. To understand the management techniques of implementing a project.

## **SUBJECT/CODE: Computer Integrated Manufacturing [402048]**

1. EXPLAIN CIM and factory automation.
2. UNDERSTAND the integration of hardware and software elements for CIM
3. APPLY CNC program for appropriate manufacturing techniques.
4. ANALYZE processes planning, quality and MRP integrated with computers.
5. INTERPRET flexible, cellular manufacturing and group technology.
6. ANALYZE the effect of IOT, Industry-4.0 and cloud base manufacturing.

  
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## **SUBJECT/CODE: Energy Engineering [402049]**

1. EXPLAIN the power generation scenario, the layout components of thermal power plant and ANALYZE the improved Rankine cycle.
2. ANALYZE the performance of steam condensers, cooling tower system; RECOGNIZE an environmental impact of energy systems and methods to control the same.
3. EXPLAIN the layout, component details of diesel engine plant, hydel and nuclear energy systems.
4. ANALYZE gas and improved power cycles.
5. EXPLAIN the fundamentals of renewable energy systems.
6. EXPLAIN basic principles of energy management, storage and economics of power generation.

## **SUBJECT/CODE: Quality & Reliability Engineering [402050]**


1. UNDERSTAND basic concepts of quality and RELATE various quality tools
2. DEVELOP analytical competencies to SOLVE problems on control charts and process capability.
3. UNDERSTAND fundamental concepts of reliability.
4. EVALUATE system reliability.
5. IDENTIFY various failure modes and CREATE fault tree diagram.
6. UNDERSTAND the concept of reliability centered maintenance and APPLY reliability tests methods.

## **SUBJECT/CODE: Energy Audit and Management [402050-B]**

1. EXPLAIN the energy need and role of energy management.
2. CARRY OUT an energy audit of the Institute/Industry/Organization.
3. ASSESS the ENCON opportunities using energy economics.
4. ANALYSE the energy conservation performance of Thermal Utilities.
5. ANALYSE the energy conservation performance of Electrical Utilities.
6. EXPLAIN the energy performance improvement by Cogeneration and WHR method.

  
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## **SUBJECT/CODE: Manufacturing System and Simulation [402050-C]**

1. UNDERSTAND the concepts of manufacturing system, characteristics, type, etc.
2. UNDERSTAND the concepts of Facilities, manufacturing planning & control and Support System.
3. UNDERSTAND the concepts of manufacturing towards solving productivity related problems.
4. DEVELOP a virtual model to solve industrial engineering related issues such as capacity. Utilization, line balancing.
5. BUILDING tools to view and control simulations and their results.
6. PLAN the data representation & evaluate the results of the simulation.

## **SUBJECT/CODE: Engineering Economics and Financial Management [402050-D]**

1. UNDERSTAND the business environment, concepts of economics and demand-supply scenario.
2. APPLY the concepts of costing and pricing to evaluate the pricing of mechanical components.
3. UNDERSTAND accounting systems and analyze financial statements using ratio analysis
4. SELECT and PREPARE the appropriate type of budget and understand the controlling aspects of budget.
5. UNDERSTAND the international business and trade system functioning.
6. DEMONSTRATE understanding of financing decisions of new ventures and performance.

  
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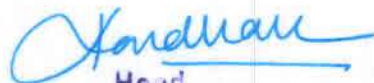
  
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## **SUBJECT/CODE: Organizational Informatics [402050-E]**

1. Demonstrate an understanding of the scope, purpose and value of information systems in an organization.
2. Understand the constituents of the information system.
3. Demonstrate the Understanding of the management of product data and features of various PLM aspects.
4. Relate the basic concepts of manufacturing system and the ERP functionalities in context of information usage.
5. Understand the manufacturing execution system and it's applications in functional areas.
6. Outline the role of the information system in various types of business and allied emerging technologies.

## **SUBJECT/CODE: Computational Multi Body Dynamics [402050-F]**

1. APPLY the basic terminology and concepts used in Multibody Dynamics to solve varieties of motion related applications.
2. IDENTIFY and EVALUATE the types of joints, its kinematics and relevant transformations.
3. DISTINGUISH and COMPARE the formulation methods.
4. DERIVE equations of motion and EVALUATE the kinematics and dynamics of rigid planar inter-connected bodies.
5. DERIVE equations of motion and EVALUATE the kinematics of rigid Spatial inter-connected bodies.
6. APPLY MBD tool effectively and SIMULATE it to solve and validate practical.
7. Multibody Dynamics problems and its solutions.



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## **SUBJECT/CODE: Process Equipment Design [402051-A]**

1. INTERPRET the different parameters involved in design of process Equipment's.
2. ANALYZE thin and thick walled cylinder.
3. DESIGN cylindrical vessel, spherical vessel, tall vessels and thick walled high pressure vessels.
4. DESIGN different process Equipments and select pump, compressor etc. and auxiliary services.
5. EVALUATE Process parameters and their correlation.
6. APPLY the concepts of process equipment design for specific applications.

## **SUBJECT/CODE: Renewable Energy Technologies [402051-B]**

1. DESCRIBE fundamentals, needs and scopes of renewable energy systems.
2. EXPLAIN performance aspects of flat and concentric solar collectors along with applications.
3. DESIGN solar photovoltaic system for residential applications.
4. DESIGN AND ANALYSIS of wind energy conversion system.
5. APPLY Installation practices of Wind and Solar Photovoltaic Systems for grid connection.
6. DETERMINE performance parameters of bio-energy conversion systems.

## **SUBJECT/CODE: Automation and Robotics [402051-C]**

1. UNDERSTAND the basic concepts of Automation.
2. UNDERSTAND the basic concepts of Robotics.
3. IDENTIFY and EVALUATE appropriate Drive for Robotic Applications.
4. COMPARE and SELECT End-effectors and Sensors as per Application.
5. DEVELOPE the Mathematical Modeling Approaches of Robot.
6. EVALUATE the fundamentals of robot programming and CLASSIFY the Applications.



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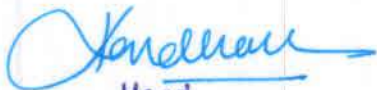
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**SUBJECT/CODE: Industrial Psychology and Organizational Behavior  
[402051-D]**

1. DEMONSTRATE fundamental knowledge about need and scope of industrial - organizational psychology and behavior.
2. ANALYZE the job requirement, have understanding of fatigue, boredom and improve the job satisfaction.
3. UNDERSTAND the approaches to enhance the performance.
4. KNOWLEDGE of theories of organizational behavior, learning and social-system.
5. UNDERSTAND the mechanism of group behavior, various aspects of team, leadership and conflict management.
6. EVALUATE the organizational culture, manage the change and understands organizational development approaches.

**SUBJECT/CODE: Electric and Hybrid Vehicle [402051-E]**

1. UNDERSTAND the basics related to e-vehicle.
2. CLASSIFY the different hybrid vehicles.
3. IDENTIFY and EVALUATE the Prime Movers, Energy Storage and Controllers.
4. DISCOVER and CATAGORIZE the Electric Vehicle Configuration with respect to Propulsion, Power distribution and Drive-Train Topologies.
5. DEVELOP body frame with appropriate suspension system and TESTING of for e-Vehicles.
6. CLASSIFY and EVALUATE Battery Charging techniques and management.



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## **SUBJECT/CODE: Electric and Hybrid Vehicle [402051-F]**

1. 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 to automate product development process, redesign from customer feedback and control of technological systems.
2. 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.
3. 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.
4. 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.
5. PRIORITIZE the concept of quality and standards, including systems reliability, safety and fitness for the intended purpose.
6. INVENT yourself to face the challenges of future technologies and their associated Problems.

## **SUBJECT/CODE: Project (Stage II) [402053]**

1. Implement systems approach.
2. To conceptualize a novel idea / technique into a product.
3. To think in terms of a multi-disciplinary environment.
4. To take on the challenges of teamwork, and document all aspects of design work.
5. To understand the management techniques of implementing a project.



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# Department of Civil Engineering

## Course Outcomes [CO'S]

### CLASS: SECOND YEAR [2019 COURSE]

#### Course Outcome

- 1 **201001: Building Technology and Architectural Planning**  
CO1: Identify types of building and basic requirements of building components.  
CO2: Make use of Architectural Principles and Building byelaws for building construction.  
CO3: Plan effectively various types of Residential Building forms according to their utility, functions with reference to National Building Code.  
CO4: Plan effectively various types of Public Buildings according to their utility functions with reference to National Building Code  
CO5: Make use of Principles of Planning in Town Planning, Different Villages and Safety aspects.  
CO6: Understand different services and safety aspects
  
- 2 **201002: Mechanics of Structures**  
CO1: Understand concept of stress-strain and determine different types of stress, strain in determinate, indeterminate homogeneous and composite structures.  
CO2. Calculate shear force and bending moment in determinate beams for different loading conditions and illustrate shear force and bending moment diagram.  
CO3. Explain the concept of shear and bending stresses in beams and demonstrate shear and bending stress distribution diagram.  
CO4. Use theory of torsion to determine the stresses in circular shaft and understand concept of Principal stresses and strains.  
CO5. Analyze axially loaded and eccentrically loaded column.  
CO6. Determine the slopes and deflection of determinate beams and trusses.
  
- 3 **201003 : Fluid Mechanics**  
CO1. Understand the use of Fluid Properties, concept of Fluid statics, basic equation of Hydrostatics, measurement of fluid pressure, buoyancy & floatation and its application for solving practical problems.  
CO2. Understand the concept of fluid kinematics with reference to Continuity equation and fluid dynamics with reference to Modified Bernoulli's equation and its application to practical problems of fluid flow  
CO3. Understand the concept of Dimensional analysis using Buckingham's  $\pi$  theorem, Similarity & Model Laws and boundary layer theory and apply it for solving practical problems of fluid flow.  
CO4. Understand the concept of laminar and turbulent flow and flow through pipes and its application to determine major and minor losses and analyze pipe network using Hardy Cross method.  
CO5. Understand the concept of open channel flow, uniform flow and depth-Energy relationships in open channel flow and make the use of Chezy's and Manning's formulae for uniform flow computation and design of most economical channel section.  
CO6. Understand the concept of gradually varied flow in open channel and fluid flow around submerged objects, compute GVF profile and calculate drag and lift force on fully submerged body.

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- 4 **207001 : Engineering Mathematics III**  
CO1. Solve Higher order linear differential equations and its applications to modelling and analysing Civil engineering problems such as bending of beams, whirling of shafts and mass spring systems.  
CO2. Solve System of linear equations using direct & iterative numerical techniques and develop solutions for ordinary differential equations using single step & multistep methods applied to hydraulics, geotechnics and structural systems.  
CO3. Apply Statistical methods like correlation, regression and probability theory in data analysis and predictions in civil engineering.  
CO4. Perform Vector differentiation & integration, analyze the vector fields and apply to fluid flow problems.  
CO5. Solve Partial differential equations such as wave equation, one and two dimensional heat flow equations.
- 5 **207003: Engineering Geology**  
CO1. Explain about the basic concepts of engineering geology, various rocks, and minerals both in lab and on the fields and their inherent characteristics and their uses in civil engineering constructions.  
CO2. Exploring the importance of mass wasting processes and various tectonic processes that hampers the design of civil engineering projects and its implications on environment and sustainability.  
CO3. Recognize effect of plate tectonics, structural geology and their significance and utility in civil engineering activities.  
CO4. Incorporate the various methods of survey, to evaluate and interpret geological nature of the rocks present at the foundations of the dams, percolation tanks, tunnels and to infer site / alignment/ level free from geological defects.  
CO5. Assess the Importance of geological nature of the site, precautions and treatments to improve the site conditions for dams, reservoirs, and tunnels.  
CO6. Explain geological hazards and importance of ground water and uses of common building stones.
- 6 **Road Safety Management Audit Course I**  
CO1: Summarize the existing road transport scenario of our country  
CO2: Explain the method of road accident investigation  
CO3: Describe the regulatory provisions needed for road safety  
CO4: Identify the safety issues for a road and make use of IRC's road safety manual for Conducting road safety audit.
- 7 **201008 : Geotechnical Engineering**  
CO1. Identify and classify the soil based on the index properties and its formation process  
CO2. Explain permeability and seepage analysis of soil by construction of flow net.  
CO3. Illustrate the effect of compaction on soil and understand the basics of stress distribution.  
CO4. Express shear strength of soil and its measurement under various drainage conditions.  
CO5. Evaluate the earth pressure due to backfill on retaining structures by using different theories.  
CO6. Analysis of stability of slopes for different types of soils.



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- 8 **201009: Surveying**  
CO1. Define and Explain basics of plane surveying and differentiate the instruments used for it.  
CO2. Express proficiency in handling surveying equipment and analyse the surveying data from these equipment.  
CO3. Describe different methods of surveying and find relative positions of points on the surface of earth.  
CO4. Execute curve setting for civil engineering projects such as roads, railways etc.  
CO5. Articulate advancements in surveying such as space based positioning systems
- 9 **201010 : Concrete Technology**  
CO1. Able to select the various ingredients of concrete and its suitable proportion to achieved desired strength.  
CO2. Able to check the properties of concrete in fresh and hardened state.  
CO3. Get acquainted to concreting equipments, techniques and different types of special concrete.  
CO4. Able to predict deteriorations in concrete and get acquainted to various repairing methods and techniques.
- 10 **201011: Structural Analysis**  
CO1. Understand the basic concept of static and kinematic indeterminacy and analysis of indeterminate beams.  
CO2. Analyze redundant trusses and able to perform approximate analysis of multi-story multi-bay frames.  
CO3. Implement application of the slope deflection method to beams and portal frames.  
CO4. Analyze beams and portal frames using moment distribution method.  
CO5. Determine response of beams and portal frames using structure approach of stiffness matrix method.  
CO6. Apply the concepts of plastic analysis in the analysis of steel structures.
- 11 **201012 : Project Management**  
CO1. Describe project life cycle and the domains of Project Management.  
CO2. Explain networking methods and their applications in planning and management  
CO3. Categorize the materials as per their annual usage and also Calculate production rate of construction equipment  
CO4. Demonstrates resource allocation techniques and apply it for manpower planning.  
CO5. Understand economical terms and different laws associated with project management  
CO6. Apply the methods of project selection and recommend the best economical project.
- 12 **201017 : Project Based Learning**  
CO1. Identify the community/ practical/ societal needs and convert the idea into a product/ process/ service.  
CO2. Analyse and design the physical/ mathematical/ ICT model in order to solve identified problem/project.  
CO3. Create, work in team and applying the solution in practical way to specific problem..



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# Department of Civil Engineering

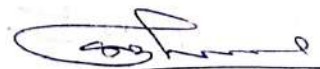
## Course Outcomes [CO'S]

### CLASS: THIRD YEAR [2019 COURSE]

- 1 **301001: Hydrology and Water Resource Engineering**
  - CO1: Understand government organizations, apply & analyze precipitation & its abstractions.
  - CO2: Understand, apply & analyze runoff, runoff hydrographs and gauging of streams.
  - CO3 :Understand, apply & analyze floods, hydrologic routing & Q-GIS software in hydrology.
  - CO4 :Understand, apply & analyze reservoir planning, capacity of reservoir & reservoir economics.
  - CO5 :Understand water logging & water management, apply & analyze ground water hydrology
  - CO6 :Understand irrigation, piped distribution network and canal revenue, apply and analyze crop water requirement
  
- 2 **301002: Water Supply Engineering**
  - CO1 :Define identify, describe reliability of water sources, estimate water requirement for various sectors
  - CO2: Ascertain and interpret water treatment method required to be adopted with respect to source and raw water characteristics
  - CO3 :Design various components of water treatment plant and distribution system.
  - CO4 :Understand and compare contemporary issues and advanced treatment operations and process available in the market, including packaged water treatment plants.
  - CO5: Design elevated service reservoir capacity and understand the rainwater harvesting.
  - CO6 :Understand the requirement of water treatment plant for infrastructure and Government scheme
  
- 3 **301003: Design of Steel Structures**
  - CO1: Demonstrate knowledge about the types of steel structures, steel code provisions and design of the adequate steel section subjected to tensile force.
  - CO2: Determine the adequate steel section subjected to compression load and design of built up columns along with lacing and battening.
  - CO3 :Design eccentrically loaded column for section strength and column bases for axial load and uniaxial bending.
  - CO4: Design of laterally restrained and unrestrained beam with and without flange plate using rolled steel section.
  - CO5: Analyze the industrial truss for dead, live and wind load and design of gantry girder for moving load.
  - C 06 :Understand the role of components of welded plate girder and design cross section for welded plate girder including stiffeners and its connections.
  
- 4 **301004: Engineering Economics and Financial Management**
  - CO1: Understand basics of construction economics.
  - CO2: Develop an understanding of financial management in civil engineering projects.
  - CO3: Prepare and analyze the contract account.
  - CO4: Decide on right source of fund for construction projects.
  - CO5: Understand working capital and its estimation for civil engineering projects.
  - CO6 :Illustrate the importance of tax planning & understand role of financial regulatory bodies

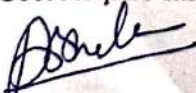


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- 5 **301005 b: Elective I: Research Methodology and IPR**  
 C01 :Understand a research problem for civil engineering domain.  
 C02 :Analyze the available literature for given research problem and illustrate different techniques of literature survey thereby gap identification.  
 C03: Recognize the importance of data collection and investigate the statistical and reliability methods of preliminary data analysis.  
 C04 :Explain the important concept of interpretation and develop technical writing and presentation skills.  
 C05 :Comprehend the various forms of the intellectual property, its relevance and business impact in the changing global business environment.  
 C06 :Realize the importance of patents, trademark and copyright and follow research ethics
- 6 **301011 b: Audit Course I: Sustainable Energy Systems**  
 C01 :To demonstrate an overview of the main sources of renewable energy.  
 C02: To understand benefits of renewable and sustainable energy systems
- 7 **301012: Waste Water Engineering**  
 C01: Recall sanitation infrastructure, quantification and characterization of wastewater, natural purification of streams  
 C02 :Design preliminary and primary unit operations in waste water treatment plant  
 C03 :Understand theory and mechanism of aerobic biological treatment system and to design activated sludge process  
 C04 :Understand and design suspended and attached growth wastewater treatment systems  
 C05 :Explain and apply concept of contaminant removal by anaerobic, tertiary and emerging wastewater treatment systems  
 C06:Compare various sludge management systems and explain the potential of recycle and reuse of wastewater treatment
- 8 **301013: Design of Reinforced Concrete Structures**  
 C01: Apply relevant IS provisions to ensure safety and serviceability of structures, understand the design philosophies and behavior of materials: steel & concrete.  
 C02 :Recognize mode of failure as per LSM and evaluate moment of resistance for singly, doubly rectangular, and flanged sections.  
 C03: Design & detailing of rectangular one way and two-way slab with different boundary conditions  
 C04: Design & detailing of dog legged and open well staircase  
 C05: Design & detailing of singly/doubly rectangular/flanged beams for flexure, shear, bond and torsion.  
 C06 :Design & detailing of short columns subjected to axial load, uni-axial/bi-axial bending and their footings.
- 9 **301014: Remote Sensing and Geographic Information System**  
 C01: Articulate fundamentals and principles of RS techniques.  
 C02 :Demonstrate the knowledge of remote sensing and sensor characteristics.  
 C03 :Distinguish working of various spaces-based positioning systems.  
 C04 :Analyze the RS data and image processing to utilize in civil engineering  
 C05 :Explain fundamentals and applications of RS and GIS  
 C06: Acquire skills of data processing and its applications using GIS

  
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- 10 **301015 e: Elective II: Architecture and Town Planning**  
C01: Apply the principles of architectural planning and landscaping for improving quality of life  
C02 :Understand the confronting issues of the area and apply the acts.  
C03 :Evaluate and defend the proposals.  
C04 :Appraise the existing condition and to develop the area for betterment.
- 11 **301016: Internship**  
C01: To develop professional competence through industry internship  
C02 :To apply academic knowledge in a personal and professional environment  
C03 :To build the professional network and expose students to future employees  
C04 :Apply professional and societal ethics in their day to day life  
C05 :To become a responsible professional having social, economic and administrative considerations  
C06 :To make own career goals and personal aspirations
- 12 **301021 b: Audit Course II: Industrial Safety**  
C01 Analyze the safety problem with its solution.



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# Department of Civil Engineering

## Course Outcomes [CO'S]

### CLASS: FINAL YEAR [2019 COURSE]

- 1 **301001: Hydrology and Water Resource Engineering**
  - C01: Understand government organizations, apply & analyze precipitation & its abstractions.
  - C02: Understand, apply & analyze runoff, runoff hydrographs and gauging of streams.
  - C03 :Understand, apply & analyze floods, hydrologic routing & Q-GIS software in hydrology.
  - C04 :Understand, apply & analyze reservoir planning, capacity of reservoir & reservoir economics.
  - C05 :Understand water logging & water management, apply & analyze ground water hydrology
  - C06 :Understand irrigation, piped distribution network and canal revenue, apply and analyze crop water requirement
- 2 **301002: Water Supply Engineering**
  - C01 :Define identify, describe reliability of water sources, estimate water requirement for various sectors
  - C02: Ascertain and interpret water treatment method required to be adopted with respect to source and raw water characteristics
  - C03 :Design various components of water treatment plant and distribution system.
  - C04 :Understand and compare contemporary issues and advanced treatment operations and process available in the market, including packaged water treatment plants.
  - C05: Design elevated service reservoir capacity and understand the rainwater harvesting.
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- 12 **301021 b: Audit Course II: Industrial Safety**  
C01 Analyze the safety problem with its solution.



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## Department of First Year Engineering

### Course Outcomes [CO'S]

**CLASS: FIRST YEAR [2019 COURSE]**

**SUBJECT/CODE: ENGINEERING MATHEMATIC'S [107001]**

#### Course Objectives:

To make the students familiarize with concepts and techniques in Calculus, Fourier series and Matrices. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

**Course Outcomes (COs):** The students will be able to learn

**CO1:** Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems.

**CO2:** the Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems.

**CO3:** to deal with derivative of functions of several variables that are essential in various branches of Engineering.

**CO4:** to apply the concept of Jacobean 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.

**CO5:** the essential tool of matrices and linear algebra in a comprehensive manner for analysis of system of linear equations, finding linear and orthogonal transformations, Eigen values and Eigen vectors applicable to engineering problems

**SUBJECT/CODE: ENGINEERING PHYSICS [107002]**

#### Course Objectives:

To teach students basic concepts and principles of physics, relate them to laboratory experiments and their applications

#### Course Outcomes:

On completion of the course, learner will be able to—

**CO1:** Develop understanding of interference, diffraction and polarization; connect it to few engineering applications.

**CO2:** Learn basics of lasers and optical fibers and their use in some applications.

**CO3:** Understand concepts and principles in quantum mechanics. Relate them to some applications.

**CO4:** Understand theory of semiconductors and their applications in some semiconductor devices.

**CO5:** Summarize basics of magnetism and superconductivity. Explore few of their technological applications.

**CO6:** Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterial's and their application.

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# SUBJECT/CODE: SYSTEMS IN MECHANICAL ENGINEERING

[102003]

## Course Objectives:

1. To identify the sources of energy and their conversions
2. To explain the basic concept of engineering thermodynamics and its application
3. To understanding the specifications of vehicles
4. To get acquainted with vehicle systems
5. To introduce manufacturing processes applying proper method to produce components
6. To be able to select and compare domestic appliances

## Course Outcomes

On completion of the course, learner will be able to

**CO1:** Describe and compare the conversion of energy from renewable and non-renewable energy sources

**CO2:** Explain basic laws of thermodynamics, heat transfer and their applications

**CO3:** List down the types of road vehicles and their specifications

**CO4:** Illustrate various basic parts and transmission system of a road vehicle

**CO5:** Discuss several manufacturing processes and identify the suitable process

**CO6:** Explain various types of mechanism and its application

  
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## SUBJECT/CODE: BASIC ELECTRICAL ENGINEERING [103004]

### Course Objectives:

1. To introduce fundamental concepts, various laws-principles and theorems associated with electrical systems.
2. To impart basic knowledge of all electrical quantities such as current, voltage, power, energy, frequency along with different types of fields.
3. To provide knowledge about fundamental parameters such as resistance, inductance and capacitance and magnetic circuits, AC and DC circuits.
4. To provide knowledge of the concepts of transformer, different energy conversion techniques.

### Course Outcomes:

At the end of course students will be able to

**CO1:** Differentiate between electrical and magnetic circuits and derive mathematical relation for self and mutual inductance along with coupling effect.

**CO2:** Calculate series, parallel and composite capacitor as well as characteristics parameters of alternating quantity and phasor arithmetic

**CO3:** Derive expression for impedance, current, power in series and parallel RLC circuit with AC supply along with phasor diagram.

**CO4:** Relate phase and line electrical quantities in polyphase networks, demonstrate the operation of single phase transformer and calculate efficiency and regulation at different loading conditions

**CO5:** Apply and analyze the resistive circuits using star-delta conversion KVL, KCL and different network theorems under DC supply.

**CO6:** Evaluate work, power, and energy relations and suggest various batteries for different applications, concept of charging and discharging and depth of charge.

## SUBJECT/CODE: PROGRAMMING AND PROBLEM SOLVING

[110005]

### Course Objectives:

Prime objective is to give students a basic introduction to programming and problem solving with computer language Python. And to introduce students not merely to the coding of computer programs, but to computational thinking, the methodology of computer programming, and the principles of good program design including modularity and encapsulation.

1. To understand problem solving, problem solving aspects, programming and to know about various program design tools.
2. To learn problem solving with computers
3. To learn basics, features and future of Python programming.
4. To acquaint with data types, input output statements, decision making, looping and functions in Python
5. To learn features of Object Oriented Programming using Python
6. To acquaint with the use and benefits of files handling in Python

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Following Fields are applicable for courses with companion Laboratory course

**Course Outcomes:** On completion of the course, learner will be able to—CO1: Inculcate and apply various skills in problem solving.

CO2: Choose most appropriate programming constructs and features to solve the problems in diversified domains.

CO3: Exhibit the programming skills for the problems those require the writing of well-documented programs including use of the logical constructs of language, Python.

CO4: Demonstrate significant experience with the Python program development environment.

  
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## SUBJECT/CODE: - WORKSHOP PRACTICE [111006]

### Course Objectives:

1. To understand the construction and working of machine tools and functions of its parts.
2. To develop the skill through hands-on practices using hand tools, power tools, machine tools in manufacturing and assembly shop leading to understanding of a production processes.
3. To understand workshop layout and safety norms.

### Course Outcomes:

**CO1:** Familiar with safety norms to prevent any mishap in workshop.

**CO2:** Able to handle appropriate hand tool, cutting tool and machine tools to manufacture a job. **CO3:** Able to understand the construction, working and functions of machine tools and their parts. **CO4:** Able to know simple operations (Turning and Facing) on a centre lathe.

## SUBJECT/CODE: ENVIRONMENTAL STUDIES-I

[101007]

### Course Objectives:

1. To explain the concepts and strategies related to sustainable development and various components of environment.
2. To examine biotic and abiotic factors within an ecosystem, to identify food chains, webs, as well as energy flow and relationships.
3. To identify and analyze various conservation methods and their effectiveness in relation to renewable and nonrenewable natural resources.
4. To gain an understanding of the value of biodiversity and current efforts to conserve biodiversity on national and local scale.

**Course Outcomes:** On completion of the course, learner will be able to—

**CO1:** Demonstrate an integrative approach to environmental issues with a focus on sustainability.

**CO2:** Explain and identify the role of the organism in energy transfers in different ecosystems. **CO3:** Distinguish between and provide examples of renewable and nonrenewable resources & analyze personal consumption of resources.

**CO4:** Identify key threats to biodiversity and develop appropriate policy options for conserving biodiversity in different settings.

  
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## SUBJECT/CODE: ENGINEERING MATHEMATICS – II [107008]

### Course Objectives:

To make the students familiarize with Mathematical Modeling of physical systems using differential equations advanced techniques of integration, tracing of curve, multiple integrals and their applications. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

**Course Outcomes (COs):** The students will be able to learn

**CO1:** the effective mathematical tools for solutions of first order differential equations that model physical processes such as Newton's law of cooling, electrical circuit, rectilinear motion, mass springsystems, heat transfer etc.

**CO2:** advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign and Error functions needed in evaluating multiple integrals and their applications.

**CO3:** to trace the curve for a given equation and measure arc length of various curves.

**CO4:** the concepts of solid geometry using equations of sphere, cone and cylinder in a comprehensive manner.

**CO5:** evaluation of multiple integrals and its application to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia.

## SUBJECT/CODE: ENGINEERING CHEMISTRY [107009]

### Course Objectives:

1. To understand technology involved in analysis and improving quality of water as commodity.
2. To acquire the knowledge of electro-analytical techniques that facilitates rapid and precise understanding of materials.
3. To understand structure, properties and applications of speciality polymers and nano material.
4. To study conventional and alternative fuels with respect to their properties and applications.
5. To study spectroscopic techniques for chemical analysis.
6. To understand corrosion mechanisms and preventive methods for corrosion control.

### Course Outcomes:

On completion of the course, learner will be able to–

**CO1:** Apply the different methodologies for analysis of water and techniques involved in softening of water as commodity.

**CO2:** Select appropriate electro-technique and method of material analysis.

**CO3:** Demonstrate the knowledge of advanced engineering materials for various engineering applications.

**CO4:** Analyze fuel and suggest use of alternative fuels.

**CO5:** Identify chemical compounds based on their structure.

**CO6:** Explain causes of corrosion and methods for minimizing corrosion.

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## SUBJECT/CODE: BASIC ELECTRONICS ENGINEERING [104010]

### Course Objectives:

1. The principle of electronics and working principle of PN junction diode and specialpurpose diodes.
2. The functioning of transistors like BJT, MOSFETs and OPAMP.
3. Basics of various logic gates, digital circuits and their applications.
4. Working and functions of various electronic instruments.
5. The operating principles and applications of various active and passive sensors.
6. Basic principles of communication systems.

**Course Outcomes:** On completion of the course, learner will be able to–

**CO1:** Explain the working of P-N junction diode and its circuits.

**CO2:** Identify types of diodes and plot their characteristics and also can compare BJT withMOSFET.

**CO3:** Build and test analog circuits using OPAMP and digital circuits using universal/basic gatesand flip flops.

**CO4:** Use different electronics measuring instruments to measure various electrical parameters.

**CO5:** Select sensors for specific applications.

**CO6:** Describe basic principles of communication systems.

## SUBJECT/CODE: ENGINEERING MECHANICS [101011]

### Course Objectives:

1. To impart knowledge about force systems and methods to determine resultant centroid andmoment of inertia
2. To teach methods to calculate force of friction
3. To impart knowledge to determine reaction of beams, calculate member forces in trusses,cables and frames using principles of equilibrium
4. To teach space force systems
5. To train students to solve problems related to particle mechanics using principles ofkinematics, kinetics and work power energy

### Course Outcomes:

On completion of the course, learner will be able to–

**CO1:** Determine resultant of various force systems

**CO2:** Determine centroid, moment of inertia and solve problems related to friction

**CO3:**Determine reactions of beams, calculate forces in cables using principles of equilibrium **CO4:** Solve trusses, frames for finding member forces and apply principles of equilibrium to forces in space

**CO5:** Calculate position, velocity and acceleration of particle using principles of kinematics **CO6:** Calculate position, velocity and acceleration of particle

using principles of kinetics and Work, Power, Energy

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## SUBJECT/CODE: ENGINEERING GRAPHICS [102012]

### Course Objectives

1. To acquire basic knowledge about engineering drawing language, line types, dimension methods, and simple geometrical construction.
2. To draw conic sections by various methods, involutes, cycloid and spiral.
3. To acquire basic knowledge about physical realization of engineering objects and shall be able to draw its different views.
4. To visualize three dimensional engineering objects and shall be able to draw their isometric views.
5. To imagine visualization of lateral development of solids.
6. To acquire basic knowledge about the various CAD drafting software's and its basic commands required to construct the simple engineering objects.

### Course Outcomes

On completion of the course, learner will be able to

CO1: Draw the fundamental engineering objects using basic rules and able to construct the simple geometries.

CO2: Construct the various engineering curves using the drawing instruments.

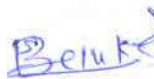
CO3: Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object.

CO4: Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment.

CO5: Draw the development of lateral surfaces for cut section of geometrical solids.

CO6: Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools.

  
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## SUBJECT/CODE: BASIC ELECTRONICS ENGINEERING [104010]

### Course Objectives:

1. The principle of electronics and working principle of PN junction diode and specialpurpose diodes.
2. The functioning of transistors like BJT, MOSFETs and OPAMP.
3. Basics of various logic gates, digital circuits and their applications.
4. Working and functions of various electronic instruments.
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6. Basic principles of communication systems.

**Course Outcomes:** On completion of the course, learner will be able to–

**CO1:** Explain the working of P-N junction diode and its circuits.

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3. To impart knowledge to determine reaction of beams, calculate member forces in trusses, cables and frames using principles of equilibrium
4. To teach space force systems
5. To train students to solve problems related to particle mechanics using principles ofkinematics, kinetics and work power energy

### Course Outcomes:

On completion of the course, learner will be able to–

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**CO3:**Determine reactions of beams, calculate forces in cables using principles of equilibrium **CO4:** Solve trusses, frames for finding member forces and apply principles of equilibrium toforces in space

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using principles of kinetics and Work, Power, Energy

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## SUBJECT/CODE: PROJECT BASED LEARNING [110013]

### Course Objectives:

1. To emphasize learning activities that are long-term, interdisciplinary and student-centric.
2. To inculcate independent learning by problem solving with social context.
3. To engage students in rich and authentic learning experiences.
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

### Course Outcomes:

1. **CO1:** Project based learning will increase their capacity and learning through shared cognition.
2. **CO2:** Students able to draw on lessons from several disciplines and apply them in practical way.
3. **CO3:** 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.

## SUBJECT/CODE: ENVIRONMENTAL STUDIES-II[101014]

### Course Objectives:

1. To provide a comprehensive overview of environmental pollution and the science and technology associated with the monitoring and control.
2. To understand the evolution of environmental policies and laws.
3. To explain the concepts behind the interrelations between environment and the development.
4. To examine a range of environmental issues in the field, and relate these to scientific theory.


**Course Outcomes:** On completion of the course, learner will be able to—


**CO1:** Have an understanding of environmental pollution and the science behind those problems and potential solutions.

**CO2:** Have knowledge of various acts and laws and will be able to identify the industries that are violating these rules.

**CO3:** Assess the impact of ever increasing human population on the biosphere: social, economic issues and role of humans in conservation of natural resources.

**CO4:** Learn skills required to research and analyze environmental issues scientifically and learn how to use those skills in applied situations such as careers that may involve environmental problems and/or issues.

  
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