

MES College of Engineering, Pune

Department of COMP
COURSE OUTCOMES

Second Year Engineering Semester I

Course Code and Name: 210241: Discrete Mathematics

1. Understand and Solve real world problems logically using appropriate set, function, and relation models and interpret the associated operations and terminologies in context.
2. Solve applications involving permutations and combinations using the fundamental counting principle.
3. Apply algorithms and use of graphs and trees as tools to visualize and simplify Problems
4. To decide a problem-solving technique dealing with algebraic structures such as groups, rings and fields etc.

Course Code and Name: 210242: Digital Electronics and Logic Design

1. Analyses Boolean algebraic assignment using K map for Combinational and Sequential circuits.
2. Design ASM chart and build VHDL codes for digital circuits.
3. Understand PLD's and design combinational circuits using PLD's.
4. Analyses members of various logic families and Understand Features, Architecture and programming mode of 8051 microcontroller.

Course Code and Name: 210243: Data Structures and Algorithms

1. To understand and apply algorithm on various data structure sequential and dynamic organization (example array and link list)
2. To understand and apply data structure like stack and queue
3. To understand and apply searching and sorting algorithm.

Course Code and Name: 210244: Computer Organization and Architecture

1. Understand the structural and functional behavior of digital computer system & perform computer arithmetic's.
2. Summarize memory hierarchy & I/O data transfer techniques of digital computer system.
3. Analyze the modern instruction sets, control unit operations and explain their effects on processors
4. Apply Super-scalar & super-pipeline approaches for commercially available computers.

Course Code and Name: 210245: Object Oriented Programming

1. Students will be able to understand and apply the features of OOP
2. Students will be able to evaluate polymorphism ,inheritance , templates, exception handling for program development
3. Students will be able to understand and apply stream and file classes
4. Students will be able to percept the applicability of STL Components

Course Code and Name: 210246: Digital Electronics Lab

1. Construct basic combinational circuits and verify their functionality.
2. Apply design procedure for sequential circuits.
3. Understand VHDL codes and study the functionalities of various logic families

Course Code and Name: 210247: Data Structures Lab

1. To apply and create data structures like array , linked list and its applications
2. To design and analyse various data structure like stack and queue .
3. To apply and analyse the algorithms to solve the programming problems using searching and sorting methods .

Course Code and Name: 210248: Object Oriented Programming Lab

1. Design and apply features of OOP to develop real time application
2. Students will be able to learn and understand working and use of function template.
3. Students will be able to demonstrate various operations on different data structures using STL
4. Students will be able to demonstrate a thorough understanding of streaminput/output for both console and files.

Course Code and Name: 210249: Soft Skills

1. Analyze their strengths and weakness which will help them for goal setting
2. Understand the importance of time and stress management
3. Demonstrate their verbal communication and listening skills by taking active participation in team building activities.
4. Write precise briefs or reports and technical documents.

Semester II**Course Code and Name: 210251: Computer Graphics**

1. Define the basic terminologies of Computer Graphics and apply mathematics to develop Computer programs for elementary graphic operations.Understand various curves and apply various algorithms to fill polygons with different pattern
2. Classify color models and describe various hidden surface removal and shading algorithms
3. Apply the logic to develop animation and interactive graphic applications using graphic tools

Course Code and Name: 210252: Advanced Data Structures

1. To understand and apply appropriate advanced data structure (like tree, graphs, and hash tables) and their efficient algorithms to approach the problems of various domain.
2. Illustrate effective and efficient data structures in problem solving using OBST, Height Balanced Tree- AVL tree, Indexing and Multiday Trees and heap.
3. Describe the importance of file structures in the Data Storage and Manipulation.

Course Code and Name: 210253: Microprocessor

1. To apply the assembly language programming to develop small real life embedded application.
2. To understand the architecture of the advanced processor thoroughly to use the resources for programming.
3. To understand the higher processor architectures descended from 80386 architectures.

Course Code and Name: 210254: Principles of Programming Languages

1. To analyze the strengths and weaknesses of programming languages for effective and efficient program development.
2. To inculcate the principles underlying the programming languages enabling to learn new programming languages.
3. To grasp different programming paradigms
4. To use the programming paradigms effectively in application development.

Course Code and Name: 210255: Computer Graphics Lab

1. Implement Line and Circle drawing Algorithms.
2. Implement 2-D transformations
3. Implement curves and fractals.
4. Create animation using OPENGL/MAYA/3DMax

Course Code and Name: 210256: Advanced Data Structures Lab

1. To apply and design ADT for different data structures and it's relevant standard algorithms using non linear organization like tree, graph, hash table.
2. To design and analyze effective and efficient data structures in problem solving for optimal solutions using dynamic organization.
3. To implement program for file structures in the Data Storage and Manipulation.
4. To understand and apply Object Oriented Programming(OOP) principles using Java

Course Code and Name: 210257: Microprocessor Lab

1. Implement assembly language programs using the various addressing modes & instruction set of the 80386 microprocessor.
2. Apply the assembly language programming to develop program using coprocessor 80387 NDP.

Third Year Engineering***Semester I*****Course Code and Name: 310241: Theory of Computation**

1. Construct finite automata, pushdown automata, Turing machines, formal languages, and grammars
2. Give examples of inter conversions of finite automata, regular expressions, grammars and pushdown automata.

3. Discuss algorithm computability, decidability, and complexity through problem solving.

Course Code and Name: 310242 : Database Management Systems

1. To summarize fundamental concepts of database management.
2. To apply SQL for Relational database management system and normalization techniques to normalize the database .
3. To analyze transaction management and classify various Database Architecture .
4. To apply non-relational database techniques for storing and processing large volumes of unstructured data.

Course Code and Name: 310243: Software Engineering and Project Management

1. To analyze process model for developing a software project
2. To classify software applications and identify unique features of various domains
3. To plan, schedule and execute project considering the risk management
4. To know basics of IT project management.
5. To design test cases of software system.

Course Code and Name: 310244: Information Systems and Engineering Economics

1. To Understand the need, usage and importance of an Information System to an organization.
2. The student would be aware of various Information System solutions like ERP, CRM, Data warehouses for successful implementation in any organization on the basis of ethical knowledge of MIS
3. To Perform and Analyse present worth, future worth and annual worth analyses on one of more economic alternatives
4. To Evaluate benefit/cost,life cycle and break even analyses on one or more economic alternatives /projects.

Course Code and Name: 310245: Computer Networks

1. To understand Networking concepts and architecture.
2. To analyze design issues and networking protocols.
3. To apply techniques to learn network programming
4. To determine functionality of protocol layerwise.

Course Code and Name: 310246: Skill Development Lab

1. Evaluate problems and analyze data using current technologies in a wide variety of business and organizational contexts.
2. Create data-driven web applications
3. Incorporate best practices for building applications.
4. Employ Integrated Development Environment(IDE) for implementing and testing of software solution.
5. Construct software solutions by evaluating alternate architectural patterns

Course Code and Name: 310247: Database Management System Lab

1. To apply SQL to design relational database.
2. To apply PLSQL efficiently to develop PL/SQL Program .
3. To differentiate between RDBMS and NoSQL databases.
4. To apply CRUD operations, indexing and aggregation for Mongoddb.
5. To design DBMS project.

Course Code and Name: 310248: Computer Networks Lab

1. To learn configuration of networks switches and routers
2. To analyze data flow and networking protocols.
3. To Develop Network and prototypes by the means of correct standards and technology.
4. To apply Tools and techniques to learn network programming.

Semester II

Course Code and Name: 310250: Design and Analysis of Algorithms

1. To summarize fundamental concepts of Algorithms
2. To apply algorithmic strategy to solve the problems.
3. To apply different NP algorithms to solve the problems NP type of problem
4. To categorize various Embedded and Scheduling algorithm.
5. Students will be able to apply distributed and multi threaded algorithmic strategies to solve given problem.

Course Code and Name: 310251: Systems Programming and Operating System

1. To Analyze and synthesize system software
2. To interpret various data structures used in macro processor, linker and loaders.
3. To use and demonstrate Linux utility.
4. To explain different utilities of operating system.
5. To summarize functionalities of I/O.

Course Code and Name: 310252: Embedded Systems and Internet of Things

1. Summarize fundamental concepts in embedded systems and IoT.
2. Identify an architectural design for specific IoT application and build small low cost embedded IoT system.
3. Adapt the various Protocols and security requirements in IoT.
4. Associate Web of things and cloud of things for interoperability across IoT Platforms.
5. Make use of available technologies for real world application scenarios of IoT along with its societal and economic impact using case studies.

Course Code and Name: 310253: Software Modeling and Design

1. Analyze and design an application using UML modeling as fundamental tool
2. Decide and apply appropriate diagrams for modeling the application.
3. Understand architecture design for modeling the application.

4. Understand the use of design patterns in OO systems.
5. Understand testing strategies for testing web- based/desktop application

Course Code and Name: 310254: Web Technology

1. To analyze given assignment and select sustainable web development design methodology.
2. To develop web based application using suitable client side and server side web technologies.
3. To develop solution to complex problems using appropriate method, technologies, advanced frameworks, web services and content management.

Course Code and Name: 310255: Seminar and Technical Communication

1. be able to be familiarize with basic technical writing concepts and terms such as audience analysis, format, visuals, and presentation.
2. be able to improve skills to read, understand, and interpret material on technology.
3. improve communication and writing skills

Course Code and Name: 310256: Web Technology Lab

1. Develop web based application using suitable client side and server side web technologies.
2. Develop solution to complex problems using appropriate method, technologies, frameworks, web services and content management.

Course Code and Name: 310257: System Programming & Operating System Lab

1. Analyze and synthesize system software
2. Use tools like LEX & YACC.
3. Implement operating system functions.
4. Implement process scheduling, resource and memory management.

Course Code and Name: 310258: Embedded Systems & Internet of Things Lab

1. Understand and demonstrate how sensors and embedded systems work.
2. Design a simple embedded IoT system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software
3. Choose between applications and web interfaces to build IoT systems with remote access and get services from server.
4. Build real- time full-fledged IoT applications for betterment of economic and social life.

Fourth Year Engineering Semester Sem I

Course Code and Name: 410241: High Performance Computing

1. Describe different parallel architectures, inter-connect networks, programming models.
2. Develop an efficient parallel algorithm to solve given problem.
3. Analyze and measure performance of modern parallel computing systems.
4. Build the logic to parallelize the programming task.

Course Code and Name: 410242: Artificial Intelligence and Robotics

1. Identify and apply suitable intelligent agents for various AI applications.
2. Design smart system using different informed search /uninformed search or heuristic approaches.
3. Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem.
4. Apply the suitable algorithms to solve AI problems like NLP, Robotics.

Course Code and Name: 410243: Data Analytics

1. Write case studies in Business Analytic and Intelligence using mathematical models.
2. Present a survey on applications for Business Analytic and Intelligence.
3. Provide problem solutions for multi-core or distributed, concurrent/Parallel environments.

Course Code and Name: 410244 (D): Elective I- Data Mining and Warehousing

1. Apply basic, intermediate and advanced techniques to mine the data.
2. Analyze the output generated by the process of data mining.
3. Explore the hidden patterns in the data.
4. Optimize the mining process by choosing best data mining technique.

Course Code and Name: 410245 (A): Elective II- Distributed Systems

1. Describe different models of distributed system, representations and concepts of distributed Algorithms.
2. Understand coordination algorithms, distributed consensus and transactions.
3. Discuss group communication and Replicated Data Management.
4. Recognize different security challenges in distributed systems.

Course Code and Name: 410245 (B): Elective II- Software Testing and Quality Assurance

1. Describe fundamental concepts in software testing such as manual testing, automation testing and software quality assurance.
2. Design and develop project test plan, design test cases, test data, and conduct test operations.
3. Apply recent automation tool for various software testing for testing software.
4. Apply different approaches of quality management, assurance, and quality standard to software system.
5. Apply and analyze effectiveness Software Quality Tools.

Course Code and Name: 410246: Laboratory Practice I

1. Analyze efficiency of parallel programs over their sequential counterparts.
2. Analyze different types of problem solving technique to solve real world problems unconventionally with optimality.
3. Analyze data and derive knowledge from information.

Course Code and Name: 410247: Laboratory Practice II

1. To study and implement various techniques of data mining.
2. To understand and implement different concepts of distributed system or software testing.

Course Code and Name: 410248:Project Work Stage I

1. To identify a problem statement and to find solution for the same.
2. To develop SRS and other software engineering documents of project.
3. To write technical article.
4. To develop presentation and communication skills and to work in teams.

Semester II**Course Code and Name: 410250: Machine Learning**

1. Distinguish different learning based applications.
2. Apply different pre-processing methods to prepare training and testing.
3. Design and analyze supervised and unsupervised machine learning algorithm. data set for machine learning algorithm.
4. Learn Meta classifiers and deep learning concepts.

Course Code and Name: 410251: Information and Cyber Security

1. Discuss the security protections and limitations in information and cyber security.
2. Use basic techniques of cryptography and differentiate between algorithms and protocols used to provide basic security.
2. Select security solutions for a specific web-based application.
4. Explain need of firewall, intrusion detection systems (IDS) , Personally Identifiable Information (PII) and cyberforensics.

Course Code and Name: 410252(D): Elective III- Soft Computing and Optimization Algorithms

1. Explain the principles of soft computing and it's applications.
2. Design and Develop Fuzzy Expert System.
3. Describe basic concepts of Evolutionary Computing.
4. Understand and Apply Optimization Algorithms.

Course Code and Name: 410253(B): Elective IV- Human Computer Interface

1. Evaluate the basics of human and computational abilities and limitations.
2. Inculcate basic theory, tools and techniques in HCI.
3. Apply the fundamental aspects of designing and evaluating interfaces.
4. Apply appropriate techniques to design systems that are usable by people.

Course Code and Name: 410253(C): Elective IV- Cloud Computing

1. To install cloud computing environment.

2. To understand different types of cloud.
3. To explore future trends of cloud computing.

Course Code and Name: 410254: Laboratory Practice III

1. Perform experiments in Machine Learning using real-world.
2. Implement various security algorithms and techniques.

Course Code and Name: 410255: Laboratory Practice IV

1. Apply soft computing techniques using Fuzzy logic sets, Neural network and Optimization Algorithm.
2. Understand various cloud types and demonstrate the cloud services.
3. Describe and apply core theories, model and methodologies for developing human computer interface.

Course Code and Name: 410256:Project Work Stage II

1. To implement problem solutions and present the result of project.
2. To develop test cases and perform testing.
3. Participate in various conference and project competitions.
4. To develop presentation and communication skills and able to work in teams.
5. To prepare concise project report

2019 SE Computer SEM I

210241: Discrete Mathematics

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

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

CO2:Identify and Apply : Discriminate the usage of various structures, Implement the appropriate data structures; use them in implementations of ADT and Identify an appropriate data Structure in approaching the problem solution.

CO3:Understand : Demonstrate use of Sequential Data Structures - Array, Linked List to store and process data

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

CO5:Analyze : Compare and contrast different implications of data structures (static and dynamic)

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

210243: Object Oriented Programming

CO1:Apply construct, 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

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

210245: Digital Electronics and Logic Design

CO1:Simplify: Boolean expression using K-map.

CO2:Design and implement: Combinational circuit.

CO3:Design and implement: sequential circuit.

CO4:Develop: Simple real-world applications using ASM and PLD.

CO5:Differentiate and choose: appropriate logic families IC packages as per the given design specification.

CO6:Explain: organization and architecture of computer system.

210246: Humanity & Social Science

CO1:**Recognize** of the various issues concerning humans and society

CO2:**Understand** about their responsibilities towards society.

CO3:**Explain** about broader issues regarding the social, cultural, economic and human aspects, involved in social changes.

CO4:**Understand** the nature of the individual and the relationship between self and the community

CO5:**Understand** major ideas, values, beliefs, and experiences that have shaped human history and cultures.

210247: Data Structures Laboratory

COURSE OUTCOMES:

CO1:**Use** appropriate modern tools to understand and analyze the functionalities confined to the secondary storage

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

CO4:**Designing and implement** :data structures and algorithms for solving different kinds of problems.

210248: OOP and Computer Graphics Laboratory

COURSE OUTCOMES:

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.

210249: Digital Electronics Laboratory

COURSE OUTCOMES:

CO1:**Understand** the working of digital electronic circuits.

CO2:Apply the knowledge to appropriate IC as per the design specifications.

CO3:**Design and implement** sequential and Combinational digital circuits as per the

210250: Business Communication Skills Laboratory

COURSE OUTCOMES:

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

Audit Course 4

SEM II

210252: Mathematics III

CO1:**Obtain** solution of higher order differential equations and apply to modeling and analyzing electrical circuits

CO2:**Apply** Z-Transform and Fourier transform techniques to solve problems which will be useful in theory of communication and digital systems

CO3:**Apply** statistical methods like correlation, regression analysis in analyzing, interpreting experimental data and probability theory in testing and quality control.

CO4:**Apply** vector differentiation and integration, analyze the vector fields and apply to Electro-magnetic fields.

CO5:**Analyze** conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

210253: Data Structures & Algorithms

CO1:Identify and articulate the complexity goals and benefits of a good hashing scheme for real-world applications.

- CO2:Apply Non-linear data structures for solving problems of various domain.
- CO3:Design and Specify the operations of a non-linear based abstract data type and implement 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 toolstounderstand analyze the functionalities confined to the secondary storage.

210254: Software Engineering

- CO1:To Analyze software requirements and formulate design solutions for a software
- CO2:Apply new software models
- CO3:Identify and handle risk management and software configuration management
- CO4:Utilize the knowledge of software testing strategies for the verification and validation of a software

210255: Microprocessor

- CO1:To Exhibit skills of assembly language programming for the Application
- CO2:To classify processor Architectures.
- CO3:To understand advanced features of 80386 microprocessor.
- CO4:To compare and contrast different processor modes.
- CO5:To use interrupts mechanism in applications.
- CO6:To differentiate between Microprocessor and Microcontoller.
- CO7:To identify and analyze the tool and techniques used to design,implement,and debug microprocessor based systems.

210256: Principles of Programming Languages

- CO1:Make use of basic principles of programming languages.
- CO2:Develop a program with Data representation and Computations.
- CO3:Develop programs using Object Oriented programming language:JAVA
- CO4:Develop application using inheritance , encapsulation and polymorphism
- CO5:Demonstrate multithreading for robust application
- CO6:Develop a simple program using basic concepts of Functional and Logic programming paradigm.

210257: Data Structures & Algorithms Laboratory

- 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 the most appropriate data structure for creating efficient solutions for engineering design situations.

210258: Microprocessor Laboratory

- CO1:Understand and apply various addressing modes and instruction set to implement assembly language programs.
- CO2:Apply logic to implement code conversion.
- CO3:Analyze and apply logic to demonstrate processor mode of operation.

210259: Code of Conduct

- CO1:To understand the basics of professional ethics in the field of Engineering and Inustrial standards

- CO2:Be aware of professional rights and responsibilities of Engineers, responsibility of safety and risk benefit analysis
CO3:Understand the impact of Engineering solutions on the society and the Environment
CO4:Acquire knowledge about the various roles of Engineers and apply it ethically

210260: Project Based Learning

- CO1:Identify the real world problems 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.

Department of E&TC
COURSE OUTCOMES

SE E&TC (SEM I)

Course: Signals and Systems (204181) (211)

- C211.1: Able to classify signals into different categories and perform elementary and convolution operations on continuous and discrete time signals.
C211.2: Able to resolve the signals in frequency domain using Fourier series and Fourier transform.
C211.3: Able to evaluate Laplace transform of given signals using LT properties and Inverse Laplace transform based on partial fraction expansion.
C211.4: Able to find correlation, probability, CDF and PDF of given random signals.

Course: Electronic Devices & Circuits (204182) (212)

- C212.1: Student should be able to recall the construction, working & characteristics of electronics component such as JFET & MOSFET.
C212.2: Student should be able to develop DC & AC analysis methodology for JFET & MOSFET.
C212.3: Student should be able to state effect of feedback on an amplifier performance.
C212.4: Student should be able to study the concept of voltage regulation and its use in power supply design

Course: Electrical Circuits and Machines (204183) (213)

- C213.1: Analyze basic AC & DC circuit for voltage, current and power by using KVL, KCL, and

network theorems.

C213.2: Explain the working principle of different electrical machines.

C213.3: Select proper electrical motor for given application.

C214.4: Design and analyze transformers.

Course: Data Structures & Algorithms (204184) (214)

C214.1: Describe basic programs & it's efficiency.

C214.2: Solve problems of data structures like stack, queues & linked list, etc. efficiently.

C214.3: Construct non-linear data structures such as trees and graphs and it's traversal methods.

Course: Digital Electronics (204185) (215)

C215.1: design combinational, sequential circuits & state machines.

C215.2: compare basic digital logic families, various PLDs and semiconductor memories.

C215.3: explain architecture, features and analyse simple programming of 8051 microcontroller.

Course: Electronic Measurement Instruments and Tools (204186) (216)

C216.1: Define fundamentals of various electrical measurements and describe specifications, features and capabilities of electronic instruments.

C216.2: Identify the specifications of instrument and select an appropriate instrument for given measurement and carry out required measurement under different setups.

C216.3: Compare measuring instruments for performance parameters

SE E&TC (SEM II)

Course: Engineering Mathematics III (207005) (221)

C221.1: **Obtain** solution of higher order differential equations and apply to modeling and analyzing electrical circuits.

C221.2: **Apply** Z-Transform and Fourier transform techniques to solve problems which will be useful in signal processing and control systems.

C221.3: **Obtain** solution of system of linear equations using direct and iterative numerical methods and develop solutions to ordinary differential equations using numerical methods.

C221.4: **Apply** vector differentiation and integration, analyze the vector fields and apply to Electro-magnetic fields.

C221.5: **Analyze** conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

Course: Integrated Circuits (204187) (222)

C222.1: Define and determine various performance parameters and their significance for OP-Amp.

C222.2: Analyse and identify linear and Non Linear applications of OP-Amp.

C222.3: Implement hardwired circuit to test performance and application for what it is being designed.

C222.4: Understand and apply the functionalities and use of PLL.

Course: Control Systems (204188) (223)

C223.1: Apply the rules of block diagram reduction technique ,signal flow graph to the given system for finding the transfer function and analyse time domain response .

C223.2: Perform time domain and frequency domain analysis of control systems required for stability analysis.

C223.3: Solve system equations in state variable form.

C223.4 :To use PLC ladder diagram for given controlling parameters and study PID controllers.

Course: Analog Communication (204189) (224)

C224.1: Understand and identify the fundamental concepts and various components of AM analog communication systems.

C224.2: Understand and identify the fundamental concepts and various components of FM analog communication systems.

C224.3: Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.

C224.4: Describe analog pulse modulation techniques and digital modulation technique.

Course: Object Oriented Programming (204190) (225)

C225.1: Describe the principles of object oriented programming

C225.2: Apply the concepts of classes, methods and inheritance to write Java programs.

C225.3: Describe and use the concepts in Java to develop user friendly program such as interface, applets

Course: Employability Skill Development (204191) (226)

C226.1: Have skills and preparedness for aptitude tests.

C226.2: Be equipped with essential communication skills (writing, verbal and non-verbal)

C226.3: Master the presentation skill and be ready for facing interviews.

C226.4: Build team and lead it for problem solving.

TE E&TC (SEM I)

Course: Digital Communication (304181) (311)

C311.1: Describe waveform coding techniques and analyse their performance.

C311.2: Analyze the performance of a baseband and pass band digital communication system.

C311.3: Perform the time and frequency domain analysis of the signals in a digital communication system.

C311.4 : Analyze spread spectrum communication system

Course: Digital Signal Processing (304182) (312)

C312.1: Apply different transforms to discrete time signals and systems.

C312.2: Design digital FIR and IIR filters as per specification.

C312.3: Design multistage sampling rate converter

Course: Electromagnetics (304183) (313)

C313.1: Apply the basic mathematical concepts related to electromagnetic vector fields .

C313.2: To apply principles of electrostatics and magnetostatics to the solutions of problems relating to electric and magnetic field and boundry conditions .

C313.3: To Solve problems relating to transmission lines using Smith chart .

C313.4 .To solve problems of uniform plane wave using Helmholtz form of the equations .

Course: Microcontrollers (304184) (314)

C314.1: Draw & explain architectures of 8051 & PIC microcontroller & impart the knowledge about the indtruction set.

C314.2: Apply programming knowledge/skills to develop simple interfacing applications.

C314.3: Design & develop real world applications.

Course: Mechatronics (304185) (315)

- C315.1: Identification of key elements of mechatronics system and its representation in terms of block diagram.
- C315.2: Explain Principle & Application of appropriate Sensors, Transducer and Actuators.
- C315.3: Able to prepare the appropriate case study of the system given

Course: Signal Processing and Communication Lab (DC/DSP)(304191) (316)

- C316.1: analyze different communication and signal characteristics.
- C316.2: verify concepts of digital communication and signal processing using appropriate software and hardware tools.
- C316.3: demonstrate digital communication and signal processing basics.

Course: Microcontroller and Mechatronics Lab (304192) (317)

- C317.1: Interface and program 8051 microcontroller with various peripherals such as LEDs, DAC, LCD etc. using Parallel port interacting.
- C317.2: Interface and program PIC microcontroller with various input output peripherals.
- C317.3: Interface Sensors, Actuators with appropriate DAQ and program it using modern automation tools.
- C317.4: Demonstrate Electro-Pneumatic Trainer kit, Pick and place robot as one of the case study.

Course: Electronic System Design (304193) (318)

- C318.1: Apply the fundamental concepts and working principles of electronics devices to devices to design electronics systems.
- C318.2: Interpret datasheets and thus select appropriate components, circuits and devices to design prototype of Data Acquisition System.
- C318.3: Create, Manage the database and query handling using suitable tools.

TE E&TC (SEM II)

Course: Power Electronics (304186) (321)

- C321.1: Analyze different Triggering and gate drive Circuits for Thyristor.
- C321.2: Design controlled converters, inverters and chopper circuits.
- C321.3: Understand power electronics applications like UPS, etc.
- C321.4: Understand the concept of protection circuits.

Course: Information Theory, Coding and Communication Networks (304187) (322)

- C322.1: Perform information theoretic analysis of communication system.
- C322.2: Design a data compression scheme using suitable source coding technique.
- C322.3: Design a channel coding scheme for a communication system.
- C322.4: Understand fundamental principles of data communication and networking and apply flow and error control techniques in communication networks.

Course: Business Management (304188) (323)

- C323.1: Get overview of various domains of business management and concept of quality management in business.
- C323.2 : Get acquainted with the project management aspects and concept of financial management with respect to business.
- C323.3: Describe role and responsibilities of HR professionals and various recent trends in human resource development.
- C323.4: Get acquainted with legal aspects regarding entrepreneurship development and importance

of marketing in business.

Course: Advanced Processor (304189) (324)

C324.1: Explain various features of ARM & CORTEX series processors. Explain need of operating system & development standard for ARM CORTEX.

C324.2: Describe architecture of ARM-7 & CORTEX -M3 microcontroller. Apply programming knowledge to interface simple applications for ARM-7 & CORTEX-M3 microcontroller.

C324.3: Design & develop real world applications for ARM-7 & CORTEX-M3 based microcontroller.

Course: System Programming and Operating Systems (304190) (325)

C325.1: explain the concept of System Programming and Operating Systems

C325.2 : explain the concept of Compiler, Interpreter, and Macro Processors

C325.3 : describe the concept of memory management, principle of I/O devices and File System

Course: Power and ITCT Lab(304194) (326)

C326.1: Perform information analysis of communication system.

C326.2: Design a data compression and error correction scheme using suitable coding technique.

C326.3: Understand the characteristics and operational features of important power electronic devices.

C326.4: Analyse the merits and demerits of power electronics converters.

Course: Advanced Processor and System Programming Lab(304195) (327)

C327.1: Develop real world interfacing applications using ARM-7 microcontroller.

C327.2: Develop real world interfacing applications using CORTEX-M3 microcontroller.

C327.3: Analyze the characteristics and operation of power electronic devices such as SCR, IGBT, MOSFET etc.

C327.4: Understand & Analyse the working principle of power electronics converters such as controlled rectifier, Inverter, SMPS, Chopper etc

Course: Employability Skills and Mini Project (304196) (328)

C328.1: Students should be able to understand problem definition according to literature survey.

C328.2: Students should be able to design block and circuit diagram of project.

C328.3: Students should be able to Implement electronic hardware by learning PCB artwork design, soldering techniques, trouble shooting etc

C328.4: Students should be able to prepare technical report & deliver seminar on their miniproject work.

BE E&TC (SEM I)

Course: VLSI Design & Technology(404181) (411)

C411.1: model digital circuit with VHDL and study the PLD architectures.

C411.2: explain chip level issues and need of testability.

C411.3: design analog & digital CMOS circuits for specified applications.

Course: Computer Networks and Security (404182) (412)

412.1: define and describe the services and features of the various layers of data network .

412.2: determine deficiencies in existing protocols in data link layer and to compare various protocols.

- 412.3: evaluate the routing protocols and examine congestion control algorithms used.
- 412.4: examine the various services of transport layer and differentiate between TCP and UDP.
- 412.5: analyze the features and operations of various application layer protocols and explain the communication systems used.

Course: Radiation and Microwave Techniques (404183) (413)

- C413.1: define and analyze various performance parameters of radiating elements.
- C413.2: explain principle and list applications of different microwave components.
- C413.3: explain the working principles of microwave tubes.
- C413.4: measure various performance parameters of microwave components.

Course: Digital Image and Video Processing (Elective I) (404184) (414)

- C4141.1: Explain the role of human visual system played in perception of gray and color image data and basic concepts of digital image processing.
- C4141.2: Learn the signal processing algorithms and techniques in image enhancement and image restoration.
- C4141.3: Acquire an appreciation for the image processing issues such as compression, segmentation, morphological operations, representation and description; and be able to apply these techniques to real world problems.
- C4141.4: Get understanding of and explore video signal representation and different algorithm for video processing.

Course: Embedded Systems and RTOS (Elective I) (404184) (414)

- C414.1: Define design metrics, various embedded technologies, software development life cycle models & Real time systems concepts. Explain ucosII kernel structure services.
- C414.2: Define Embedded Linux concepts development environment & various tools. Explain Linux kernel construction.
- C414.3: Explain the hardware – software design & co-design issues and testing methodology for Embedded system.

Course: Internet of Things (Elective I) (404184) (414)

- C414.1: Understand the various concepts, terminologies and architecture of IoT systems.
- C414.2: Use sensors and actuators for design of IoT.
- C414.3: Understand and apply various protocols for design of IoT systems
- C414.4: Use various techniques of data storage and analytics in IoT
- C414.5: Understand various applications of IoT

Course: Artificial Intelligence (Elective II) (404185) (415)

- C415.1: List out and describe various types of algorithms useful in Artificial Intelligence.
- C415.2: Explain various knowledge representation techniques and problem solving strategies.
- C415.3: Describe various forms of learning for AI agent.

Course: Electronics in Agriculture (Elective II) (404185) (415)

- C415.1: Understand Role of computers & virtual instrumentation. □
- C415.2: Provide communication solution for interpreting environmental parameters with Electronics systems. □
- C415.3: Describe Instrument technology used in agriculture. □
- C415.4: Apply knowledge of Electronics in Agriculture . □
- C415.5: Understand Greenhouse Technology & Role of Electronics Governance. □

Course: Lab Practice – I (CNS + RMT) (404186) (416)

- C416.1: Choose a suitable microwave component to carry out the required measurements.

- C416.2: To set up a microwave bench using Reflex Klystron tube or Gunn Diode as a oscillator.
C416.3: Develop knowledge to implement Client Server applications.
C416.4: Have a basic knowledge of installing and configuring networking applications.

Course: Lab Practice – II (VLSI + Elective - I) (404187) (417)

- C417.1: to learn and communicate the basic concepts of core GNU Radio, image processing, embedded systems and VLSI.
C417.2: use the modern tools/software to design and implement a system as per the given specifications in the area of VLSI, Embedded, Digital Image Processing and Software Defined Radio.
C417.3: To design CMOS layout in selected technology of VLSI , design flow graphs , choose blocks and define connection using GNU Radio

Course: Project Stage – I (404188) (418)

- C418.1: Identify, formulate and design the solution for engineering problem by investigating the literature.
C418.2: communicate the project ideas effectively in team along with documentation.

BE E&TC (SEM II)

Course: Mobile Communication (404189) (421)

- C421.1 : The student should be able to apply the concepts of telecommunication switching, traffic and networks.
C421.2: The student should be able to analyze the telecommunication traffic.
C421.3: The student should be able to analyze radio channel and cellular capacity.
C421.4: The student should be able to explain and apply concepts of GSM and CDMA system.

Course: Broadband Communication Systems (404190) (422)

- C422.1:To Identify the basic elements of fiber optics communication link,sources ,detectors, fiber modes & configuration.
C422.2: To identify various losses along the optical link ,identify distortion & degradation of signals and To design Analog Link and Digital link budget to achieve SNR and BER of an optical communication system.
C422.3 :To learn fundamentals of Satellite Communication system, fundamentals of orbital mechanics
C422.4 :To Carry out Satellite Link design for Up Link and Down Link.

Course: Machine Learning (Elective III) (404191) (423)

- C423.1: To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
C423.2: To mathematically analyze various machine learning approaches and paradigms.
C423.3. To implement convolution neural networks in recognition applications.

Course: Audio and Speech Processing (Elective III) (404191) (423)

- C423.1: Able to implement time and frequency domain methods for audio processing.
C423.2: Able to extract the information of the speech or audio signals in terms of cepstral features.
C423.3: Able to perform the analysis of speech signal using LPC.

Course: Software Defined Radio (Elective III) (404191) (423)

- C423.1: Compare SDR with traditional hardware radio and its reconfiguration features defined by

software to build a Modern Radio System

C423.2: Change of Sampling rate as needed for flexibility and reconfiguration of radio and design of ADC /DAC ,dynamic range ,need of decimation ,interpolation , errors-aliasing , jitters and application of data converters in Trans receivers and defining of hardware using software instructions

C423.3: Software communication architecture and open source programming using GNU radio which enable the software to be defined to drive the radio

C423.4: Implement modern wireless system based on OFDM ,MIMO & SMART ANTENNA

Course: Renewable Energy Systems (Elective-IV) (404192) (424)

C424.1: Interpret energy reserves of India and potential of different energy sources.

C424.2: Measure the solar radiation parameters and performance of different solar collectors.

C424.3: Calculate different parameters of wind turbine rotor.

C424.4: Implicit the importance and applications of geothermal and ocean energy.

C424.5: Demonstrate knowledge in field of fuel cell and potential for power generation.

Course: Lab Practice – III(MC and BCS) (404193) (425)

C425.1: The student should be able to set up and perform experiment on telecommunication switching and mobile communication and optical communication system.

C425.2: As a part of their term work, students should visit the MTSO office and hence should be able to understand and observe actual switching systems and mobile communication technology.

C425.3: Students should be able to Establish a direct communication link between Uplink Transmitter and Downlink Receiver using tone signal , To establish an AUDIO-VIDEO satellite link between Transmitter and Receiver ,to find out the link failure.

Course: Lab Practice – IV(Elective III) (404194) (426)

C426.1: Learn and communicate the fundamentals of Speech and audio signal processing or Soft computing.

C426.2: Implement algorithms for processing speech and audio signals and analyze its characteristics.

C426.3: To solve the problems using neural networks techniques and to find the solution using different fuzzy logic techniques.

Course: Project Stage – II (404195) (427)

C427.1: Identify , formulate and design the solution for engineering problem by investigating the literature.

C427.2: Apply appropriate modern tools, technologies or multidisciplinary approach to produce engineering solutions which will be beneficial to society and environment.

C427.3: Demonstrate the project and communicate effectively in team, apply ethical ergonomic, and safety constraints in the project work.

C427.4: Demonstrate knowledge and understanding of engineering and management principles and use it for life long learning.

Department of Mechanical Engineering
COURSE OUTCOMES

SE SEM 1

Solid Mechanics **202041 NBA Code - 211**

CO1 : DEFINE various types of stresses and strain developed on determinate and indeterminate

CO2 : DEFINE various types of stresses and strain developed on determinate and indeterminate members

CO3: COMPUTE the slope & deflection, bending stresses and shear stresses on a beam.

CO4: CALCULATE torsional shear stress in shaft and buckling on the column.

CO5: APPLY the concept of principal stresses and theories of failure to determine stresses on a 2-D element

CO6: UTILIZE the concepts of SFD & BMD, torsion and principal stresses to solve combined loading application based problems.

Solid Modeling and Drafting **202042 NBA Code - 212**

CO1 : UNDERSTAND basic concepts of CAD system, need and scope in Product Lifecycle Management

CO2 : UTILIZE knowledge of curves and surfacing features and methods to create complex solid geometry

CO3: CONSTRUCT solid models, assemblies using various modeling techniques & PERFORM mass property analysis, including creating and using a coordinate system

CO4: APPLY geometric transformations to simple 2D geometries

CO5: USE CAD model data for various CAD based engineering applications viz. production drawings, 3D printing, FEA, CFD, MBD, CAE, CAM, etc.

CO6: USE PMI & MBD approach for communication

Engineering Thermodynamics 202043 NBA Code - 213

CO1 : DESCRIBE the basics of thermodynamics with heat and work interactions

CO2 : APPLY laws of thermodynamics to steady flow and non-flow processes.

CO3: APPLY entropy, available and non available energy for an Open and Closed System,

CO4: DETERMINE the properties of steam and their effect on performance of vapour power cycle.

CO5. ANALYSE the fuel combustion process and products of combustion.

CO6: SELECT various instrumentations required for safe and efficient operation of steam generator

Engineering Materials and Metallurgy 202044 NBA Code - 214

CO1 : COMPARE crystal structures and ASSESS different lattice parameters.

CO2 : CORRELATE crystal structures and imperfections in crystals with mechanical behaviour of materials

CO3: DIFFERENTIATE and DETERMINE mechanical properties using destructive and non-destructive testing of materials.

CO4: IDENTIFY & ESTIMATE different parameters of the system viz., phases, variables, component, grains, grain boundary, and degree of freedom. etc

CO5: ANALYSE effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy

CO6: SELECT appropriate materials for various applications.

Electrical and Electronics Engineering 203156 NBA Code - 215

CO1 : To understand Arduino IDE; an open source platform and its basic programming features

CO2 : To interface Atmega328 based Arduino board with different devices and sensors

CO3: To study principle of operation of DC machines and speed control of DC motors

CO4: To know about three phase induction motor working and its applications

CO5: To get acquainted with Electric Vehicle (EV) technology and subsystems

CO6: To get familiar with various energy storage devices and electrical drives

Geometric Dimensioning and Tolerancing Lab 202045 NBA Code - 216

- CO1 : SELECT appropriate IS and ASME standards for drawing
- CO2 : READ & ANALYSE variety of industrial drawings
- CO3: APPLY geometric and dimensional tolerance, surface finish symbols in drawing
- CO4: EVALUATE dimensional tolerance based on type of fit, etc.
- CO5: SELECT an appropriate manufacturing process using DFM, DFA, etc.

SE SEM 2

Engineering Mathematics -III 207002 NBA Code - 221

- CO1 : SOLVE higher order linear differential equations and its applications to model and analyze mass spring systems.
- CO2 : APPLY Integral transform techniques such as Laplace transform and Fourier transform to solve differential equations involved in vibration theory, heat transfer and related mechanical engineering applications.
- CO3: APPLY Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to reliability engineering and probability theory in testing and quality control.
- CO4: PERFORM Vector differentiation & integration, analyze the vector fields and APPLY to fluid flow problems.
- CO5: SOLVE Partial differential equations such as wave equation, one and two dimensional heat flow equations

Kinematics of Machinery 202047 NBA Code - 222

- CO1 : APPLY kinematic analysis to simple mechanisms
- CO2 : ANALYZE velocity and acceleration in mechanisms by vector and graphical method
- CO3: SYNTHESIZE a four bar mechanism with analytical and graphical methods
- CO4: APPLY fundamentals of gear theory as a prerequisite for gear design
- CO5: CONSTRUCT cam profile for given follower motion

Applied Thermodynamics 202048 NBA Code - 223

- CO1 : COMPUTE COP of refrigeration system and ANALYZE psychrometric processes

CO2 : DISCUSS basic of engine terminology, air standard, fuel air & actual cycles

CO3: IDENTIFY factors affecting the combustion performance of SI & CI engines

CO4: COMPUTE performance parameters of IC engines & emission control

CO5: EXPLAIN working of various IC engine systems & use of alternative fuels

CO6: COMPUTE performance of single & multistage reciprocating compressors & DISCUSS rotary positive displacement compressors

Fluid Mechanics

202049 NBA Code - 224

CO1 : DETERMINE various properties of fluid

CO2 : APPLY the laws of fluid statics and concepts of buoyancy

CO3: IDENTIFY types of fluid flow and terms associated in fluid kinematics

CO4: APPLY principles of fluid dynamics to laminar flow

CO5: ESTIMATE friction and minor losses in internal flows and DETERMINE boundary layer formation over an external surface

CO6: CONSTRUCT mathematical correlation considering dimensionless parameters, also ABLE to predict the performance of prototype using model laws

Manufacturing Processes

202050 NBA Code - 225

CO1 : SELECT appropriate moulding, core making and melting practice and estimate pouring time, solidification rate and DESIGN riser size and location for sand casting process

CO2 : UNDERSTAND mechanism of metal forming techniques and CALCULATE load required for flat rolling

CO3: DEMONSTRATE press working operations and APPLY the basic principles to DESIGN dies and tools for forming and shearing operations

CO4: CLASSIFY and EXPLAIN different welding processes and EVALUATE welding characteristics

CO5: DIFFERENTIATE thermoplastics and thermosetting and EXPLAIN polymer processing techniques

CO6: UNDERSTAND the principle of manufacturing of fibre-reinforce composites and metal matrix composites

Machine Shop 202051 NBA Code - 226

CO1 : PERFORM welding using TIG/ MIG/ Resistance/Gas welding technique

- CO2 : MAKE Fibre-reinforced Composites by hand lay-up process or spray lay-up techniques
- CO3: PERFORM cylindrical/surface grinding operation and CALCULATE its machining time
- CO4: DETERMINE number of indexing movements required and acquire skills to PRODUCE a spur gear on a horizontal milling machine
- CO5: UNDERSTAND procedure of plastic processing

Project Based Learning -II 202052 NBA Code - 227

- CO1 : IDENTIFY the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aims and objectives
- CO2 : ANALYZE the results and arrive at valid conclusions.
- CO3: PROPOSE a suitable solution based on the fundamentals of mechanical engineering by possibly integration of previously acquired knowledge.
- CO4: CONTRIBUTE to society through proposed solutions by strictly following professional ethics and safety measures.
- CO5: USE of technology in proposed work and demonstrate learning in oral and written form.
- CO6: DEVELOP ability to work as an individual and as a team member.

TE SEM 1

Design of Machine Elements-I 302041 NBA Code - 311

- CO1 : Describe strength, rigidity, factor of safety and service factor.
- CO2 : Design different machine elements like shaft, keys, cotter and knuckle joints, levers.
- CO3: Determine finite and infinite life of machine elements subjected to fluctuating loads.
- CO4: Design threaded and welded joint for various loading and supporting conditions.
- CO5: Design helical compression & tension springs for strength & stiffness.

Heat Transfer 302042 NBA Code - 312

- CO1 : Define various modes of heat transfer and governing laws of conduction, convection and radiation
- CO2 : Apply heat conduction equation to thermal system with & without internal heat generation and transient heat conduction
- CO3: Analyze heat transfer rate in natural and forced convection
- CO4: Interpret heat transfer by radiation between objects with simple geometries
- CO5: Analyze heat transfer equipments and investigate the performance.

Theory of Machines-II 302043 NBA Code - 313

- CO1 : Explain terminology, law, forces & various concepts of gear and use it to solve the numerical
- CO2 : Analyze speed and torque in different type of gear train using tabular and analytical method
- CO3: Draw cam profile for various types of follower and follower motion
- CO4: Synthesize four bar and slider crank mechanism with analytical and graphical method
- CO5: Analyze the arthroscopic couple & its effect for stabilization of ship, aeroplane & four wheelers vehicle

Turbo Machines 302044 NBA Code - 314

- CO1 : DEFINE impulse momentum principle and working principle of turbo machines
- CO2 : DETERMINE performance of hydraulic turbines and draw the performance characteristics of Pelton wheel, Francis and Kaplan turbine.
- CO3: EXPLAIN the working principle of steam turbine and governing of steam turbines.
- CO4: ILLUSTRATE construction and working principle of energy consuming turbo machines and DETERMINE the performance characteristics of energy consuming turbo machines

Metrology and Quality Control 302045 NBA Code - 315

- CO1 : Classify, List and Use the accurate and precise instrument for inspection of geometric and dimensional measurement, standard used and errors in the measurement.
- CO2 : Design the inspection gauge and Able to analyze gear and thread metrology parameters
- CO3: Operate comparators, interferometers during measurements and Outline advancement in metrological techniques like CMM, Machine vision system and Lasers.
- CO4: Describe concept of quality, appropriate quality management system and improvement of quality deployment.
- CO5: Analyze the processes of quality control using statistical quality control, acceptance sampling and improvement using total quality management tools.

Skill Development 302046 NBA Code - 316

- CO1 : Draw different assemblies such as Tail stock assembly, Valve assembly (PVR, Sluice valve, Steam stop valve) , IC engine of two wheeler (4 stroke single cylinder), Hermetically sealed compressor, Hydraulic actuator, Industrial gear box etc. manually
- CO2 : Explain practical aspect of each component of various assemblies such as Tail stock assembly, Valve assembly (PVR, Sluice valve, Steam stop valve) , IC engine of two wheeler (4 stroke single cylinder), Hermetically sealed compressor, Hydraulic actuator, Industrial gear box etc.
- CO3: USE different tools and tackles used in machine assembly

TE SEM 2

Design of Machine Elements II

302048 NBA Code - 322

CO1 : APPLY the principle of Spur gear design for industrial application and PREPARE a manufacturing drawing with concept of GD&T.

CO2 : EXPLAIN and DESIGN Helical and Bevel Gear considering strength, loading and other gear design parameters.

CO3: SELECT Rolling Contact Bearings from manufacturer's catalog for different speed, working Hrs., probability and load conditions.

CO4: APPLY procedure of worm gear design for various application considering strength, Loading and Heat criteria

CO5: SUMMARIZE the design procedure of belt, rope and chain drive for different conditions and SELECT it from the manufacturer's catalog.

Manufacturing Process -II 302051 NBA Code - 325

CO1 : APPLY the knowledge of various manufacturing processes.

CO2 : IDENTIFY various process parameters and their effect on processes.

CO3: POINT OUT application of modern machining.

CO4: DESIGN Jigs and Fixtures for a variety of operations.

Numerical Methods & Optimization 302047 NBA Code - 321

CO1 : Use appropriate Numerical Methods to solve complex mechanical engineering problems.

CO2 : Formulate algorithms and programming.

CO3: Use a Mathematical Solver.

CO4: Generate Solutions for real life problems using optimization techniques.

CO5: Analyze the research problem

Refrigeration and Air Conditioning 302049 NBA Code - 323

CO1 : Define basic principles of Refrigeration and Air-Conditioning

CO2 : Apply fundamental principles of Refrigeration and Air-Conditioning

CO3: Select proper Refrigerants for different applications depending on their properties and environmental issues

CO4: Design Vapor Compression Refrigeration and Air-Conditioning Systems using P-h and Psychrometric Chart

CO5: Analyze Performance of Refrigeration and Air-conditioning systems

Mechatronics**302050 NBA Code - 324**

- CO1 : ANALYZE different types of sensors, Actuators and measurement systems.
- CO2 : EXPLAIN concept of transfer function, Block diagram reduction rules and SOLVE numerical on block diagram reduction
- CO3: EXPLAIN principles of signal communication and interfacing of sensor/actuator with DAQ system.
- CO4: EXPLAIN PLC system and its ladder programming and DISCUSS significance of PLC systems in industrial application
- CO5: DESCRIBE system modeling and analysis in time domain and frequency domain
- CO6: IDENTIFY control actions such as Proportional, integral and derivative and APPLY its significance in industrial applications

Machine Shop-II**302052 NBA Code - 326**

- CO1 : EXPLAIN Working of Lathe Machine,Drilling Machine,Milling Machine,Surface Grinding Machine and Taps
- CO2 : DEMONSTRATE CNC Programming to produce a program for given jobs
- CO3: DRAW Proportional drawing of drilling jig for for a component
- CO4: DRAW Process planning sheet for turning job.

Seminar**302053 NBA Code - 327**

- CO1 : Establish motivation for any topic of interest and develop thought process for technical presentation
- CO2 : To organise a detailed literature survey
- CO3: analyse and comprehension of data
- CO4: To learn effective presentation and improve soft skills

BE SEM 1**Hydraulics and Pneumatics****402041 NBA Code - 411**

- CO1 : Understand working principle of components used in hydraulic & pneumatic systems
- CO2 : Identify various applications of hydraulic & pneumatic systems
- CO3: Selection of appropriate components required for hydraulic and pneumatic systems
- CO4: Analyse hydraulic and pneumatic systems for industrial/mobile applications
- CO5: Design a system according to the requirements
- CO6: Develop and apply knowledge to various applications

CAD CAM Automation**402042 NBA Code - 412**

CO1 : Apply homogeneous transformation matrix for geometrical transformations of 2D CAD entities

CO2 : Predict mathematical model for analytical curves

CO3: Critique performance of simple mechanical components or trusses using FEA (Mathematical and Software treatment)

CO4: Generate CNC program using appropriate manufacturing technique viz. turning, milling

CO5: Understanding of various rapid manufacturing techniques and developing competency in designing and developing products using rapid manufacturing technology.

CO6: Discuss role and components of different robotic systems and their applications in manufacturing industries.

Dynamics of Machinery**402043 NBA Code - 413**

CO1 : Apply balancing technique for static and dynamic balancing of multi cylinder inline and radial engines.

CO2 : Estimate natural frequency for single DOF undamped & damped free vibratory systems.

CO3: Determine response to forced vibrations due to harmonic excitation, base excitation and excitation due to unbalance forces.

CO4: Estimate natural frequencies, mode shapes for 2 DOF undamped free longitudinal and torsional vibratory systems.

CO5: Describe vibration measuring instruments for industrial / real life applications along with suitable methods for vibration control.

CO6: Explain noise, its measurement & noise reduction techniques for industry and day today life problems.

Finite Element Analysis**402044A NBA Code - 414A**

CO1 : Understand the different techniques used to solve mechanical engineering problems.

CO2 : Derive and use 1-D and 2-D element stiffness matrices and load vectors from various methods to solve for displacements and stresses.

CO3: Apply mechanics of materials and machine design topics to provide preliminary results used for testing the reasonableness of finite element results.

CO4: Explain the inner workings of a finite element code for linear stress, displacement, temperature and modal analysis.

CO5: Use commercial finite element analysis software to solve complex problems in solid mechanics and heat transfer.

CO6: Interpret the results of finite element analyses and make an assessment of the results in terms of modeling (physics assumptions) errors, discretization (mesh density and refinement toward

convergence) errors, and numerical (round-off) errors.

Computational Fluid Dynamics **402044B NBA Code - 414B**

CO1 : Analyze and model fluid flow and heat transfer problems

CO2 : Generate high quality grids and interpret the correctness of numerical results with physics

CO3: Conceptualize the programming skills

CO4: Use a CFD tool effectively for practical problems and research.

Heating Ventilation and Air Conditioning **402044C NBA Code - 414C**

CO1 : Determine the performance parameters of trans-critical & ejector refrigeration systems.

CO2 : Estimate thermal performance of compressor, evaporator, condenser and cooling tower.

CO3: Describe refrigerant piping design, capacity & safety controls and balancing of vapour compressor system

CO4: Explain importance of indoor and outdoor design conditions, IAQ, ventilation and air distribution system.

CO5: Estimate heat transmission through building walls using CLTD and decrement factor & time lag methods with energy-efficient and cost-effective measures for building envelope.

CO6: Explain working of types of desiccant, evaporative, thermal storage, radiant cooling, clean room and heat pump air-conditioning systems

Automobile Engineering **402045A NBA Code - 415A**

CO1 : To compare and select the proper automotive system for the vehicle.

CO2 : To analyse the performance of the vehicle.

CO3: To diagnose the faults of automobile vehicles.

CO4: To apply the knowledge of EVs, HEVs and solar vehicles

Operation Research **402045B NBA Code - 415B**

CO1 : Solve LPP and Decision Theory problems

CO2 : Solve transportation models & assignment models to optimize available resources.

CO3: Solve Game Theory to find appropriate strategy

CO4: Determine various project characteristics by CPM & PERT

CO5: Solve Queuing Theory and sequencing model to optimize the process.

CO6: Solve problems by Integer and Dynamic programming

Energy Audit and Management 402045C NBA Code - 415C

CO1 : Discuss General aspects of Engineering management, policy, action planning and environmental impact (India and world).

CO2 : Demonstrate Energy Auditing and energy conservation of Thermal Utilities like Boiler, Compressor, Pump etc. and Compute Energy performance and efficiency improvement

CO3: Illustrate Costing of Utilities, Financial Analysis Techniques using simple payback, NPV, ROI, IRR and sensitivity analysis.

CO4: Analyze an energy performance assessment and efficiency improvement of Boilers, Furnaces, Heat exchangers, Fans and blowers, pumps, Compressors and HVAC systems

CO5: Analyze Energy Conservation opportunities in electrical utilities like electric motor and lighting

CO6: Discuss Cogeneration, Waste Heat recovery, CMD project and carbon credit calculations

Project Stage I 402046 NBA CODE- 416

CO1 : IDENTIFY and ANALYZE and create economically feasible solutions for problems.

CO2 : DESIGN a solution for problem by and COMPARE different modern tools and experimentation methodologies

CO3: DEVELOP skills to work effectively in team

CO4: COMPILE Technical, Research documents and DEVELOP presentation skills to communicate effectively

BE SEM 2

Mechanical System Design 402048 NBA Code - 422

CO1 : Describe optimum design principles and apply to Mechanical Components.

CO2 : Design various mechanical systems like pressure vessels, machine tool gear boxes, material handling systems, etc. for the stated applications.

CO3: Determine the reliability of mechanical components.

CO4: Design components of IC Engine.

Energy Engineering 402047 NBA Code - 421

CO1 : EXPLAIN different components of thermal power plant and DISCUSS different power cycles

CO2 : EXPLAIN different components along with working of steam condensing plant and DISCUSS method to reduce various pollution from thermal power plant

CO3: EXPLAIN components details of hydroelectric power plant & Nuclear power plant

CO4: DISCUSS Different components and layout of diesel and gas power plant

CO5: DISCUSS Working principle and construction of non conventional power plant

CO6: GENERALIZE different instrumentations in power plant and basic of economics of power plant

Industrial Engineering 402049B NBA Code - 423B

CO1 : Define the basic concepts and principles of Industrial Engineering

CO2 : Explain the concepts of Work Study, method study and value analysis

CO3: Apply work measurement and time study methods involving PMTS,MTM, MOST techniques

CO4: Analyze Production, planning, control methods and supply chain management techniques.

CO5: Design plant layout, study of material handling devices and inventory control methods

CO6: Develop engineering economy and costing, human resources development and study of industrial safety methods.

Robotics 402049C NBA Code - 423C

CO1 : Identify different types of robot configuration with relevant terminology.

CO2 : Select suitable sensors, actuators and drives for robotic systems.

CO3: Understand kinematics in robotic systems.

CO4: Design robot with desired motion with suitable trajectory planning.

CO5: Select appropriate robot programming for a given application.

CO6: Understand the need of IoT, machine learning, simulation in robotics.

Tribology 402049A NBA Code - 423A

CO1 : To describe the importance of Tribology in Industry.

CO2 : To apply the basic concepts of Friction, Wear, Lubricants and their measurements.

CO3: To estimate the performance of different types of bearings and analytical analysis thereof.

CO4: To apply the principles of surface engineering for different applications of tribology

Advanced Manufacturing Processes 402050A NBA Code - 424A

CO1 : Classify and Analyze special forming process

CO2 : Analyze and Identify applicability of Advanced joining process

CO3: Understand the basic mechanisms of hybrid non-conventional manufacturing processes

CO4: Select appropriate Micro and Nano fabrication techniques for engineering applications

CO5: Understand and Apply various additive manufacturing technology for product development

CO6: Understand material characterization techniques for material analysis.

Product Design and Development 402050CNBA Code - 424C

CO1 : Understand essential factors for product design

CO2 : Design product as per customer needs and satisfaction

CO3: Understand Processes and concepts during product development

CO4: Understand methods and processes of Forward and Reverse engineering

CO5: Carry various design processes as DFA, DFMEA, design for safety

CO6: Understand the product life cycle and product data management

Solar & Wind Energy 402050BNBA Code - 424B

CO1 : Understand Solar geometry

CO2 : Understand solar applications

CO3: Design solar food dryer

CO4: Design miniature windmill

Project Stage II 402051 NBA CODE- 425

CO1 : IDENTIFY and ANALYZE and create economically feasible solutions for problems.

CO2 : DESIGN a solution for problem by and COMPARE different modern tools and experimentation methodologies

CO3: DEVELOP skills to work effectively in team

CO4: COMPILE Technical, Research documents and DEVELOP presentation skills to communicate effectively

Department of FE
COURSE OUTCOMES

Course: Engineering Mathematics I (107001) (111)

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 Jacobian to find partial derivative of implicit function and functional dependence. Use of partial derivatives in estimating error and approximation and finding extreme values of the function
- 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

Course: Engineering Physics (107002) (112)

- CO1 Develop understanding of interference, diffraction and polarization; connect it to few engineering applications.
- CO2 Learn basics of lasers and optical fibers and their use in some applications.
- CO3 Understand concepts and principles in quantum mechanics. Relate them to some applications.
- CO4 Understand theory of semiconductors and their applications in some semiconductor devices.
- CO5 Summarize basics of magnetism and superconductivity. Explore few of their technological applications.
- CO6 Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterials and their application.

Course: Systems in mechanical Engineering () (113)

- 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

Course: Basic electronics Engineering (104010) (114)

CO1 Describe the working of rectifier circuits, P-N junction diode, and special purpose diodes.

CO2 Plot characteristics of BJT, MOSFET and explain op-amp and its types.

CO3 Explain the digital circuits using basic gates and flip flops.

CO4 Explain different electronics measuring instruments to measure various electrical parameters.

CO5 Explain sensors for specific applications.

CO6 Explain basic fundamentals of Electronics communication systems

Course: Programing and Problem solving(110005) (115)

CO1 Inculcate and apply various skills in problem solving.

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

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

CO4 Demonstrate significant experience with the Python program development environment

Course: Workshop(111006) (116)

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.

Course: Environment studies I(101007) (117)

- 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.

Course: Engineering Mathematics II (102012) (121)

- CO1 the effective mathematical tools for solutions of first order differential equations that model physical processes such as Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc.
- CO2 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.

Course: Engineering Chemistry (107009) (122)

- 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.

Course: Engineering mechanics (101011) (123)

- 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

Course: Basic Electrical Engineering (103004) (124)

- CO1 Differentiate between electrical and magnetic circuits and derive mathematical relation for self and mutual inductance along with coupling effect.
- CO2 Calculate series, parallel and composite capacitor as well as characteristics parameters of alternating quantity and phasor arithmetic
- CO3 Derive expression for impedance, current, power in series and parallel RLC circuit with AC supply along with phasor diagram.
- CO4 Relate phase and line electrical quantities in polyphase networks, demonstrate the operation of single phase transformer and calculate efficiency and regulation at different loading conditions
- CO5 Apply and analyze the resistive circuits using star-delta conversion KVL, KCL and different network theorems under DC supply.

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

Course: Engineering Graphics (102012) (125)

CO1 To acquire basic knowledge about engineering drawing language, line types, dimension methods, and simple geometrical construction.

CO2 To draw conic sections by various methods, involutes, cycloid and spiral.

CO3 To acquire basic knowledge about physical realization of engineering objects and shall be able to draw its different views

CO4 To visualize three dimensional engineering objects and shall be able to draw their isometric views.

CO5 To imagine visualization of lateral development of solids.

CO6 To acquire basic knowledge about the various CAD drafting software's and its basic commands required to construct the simple engineering objects

Course: Project based learning (100013) (126)

CO1 Project based learning will increase their capacity and learning through shared cognition.

CO2 Students able to draw on lessons from several disciplines and apply them in practical way.

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.

Course: Environmental studies (101014) (127)

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.

Course: Physical education, exercise and field activities (107015) (128)

Course: Democracy, Election and Governance (129)

CO1 : Students should able to understand the Democracy and its Foundation and Dimensions

CO2: Students should able to understand the Indian tradition of decentralization, Panchayat Raj and 73rd and 74th amendments

CO3: Students should able to understand the governance