JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

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B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

MECHANICAL ENGINEERING

I YEAR COURSE STRUCTURE AND SYLLABUS

B.TECH. –MECHANICAL EGINEERING - COURSE STRUCTURE & SYLLABUS – R23

(Applicable from the academic year 2023-24 onwards)

INDUCTION PROGRAMME

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

B.Tech. – I Year I Semester

S.No.	Course code	Title	L/D	T	P	Credits
1	23A56101T	Engineering Physics	3	0	0	3
2	23A54101	Linear Algebra & Calculus	3	0	0	3
3	23A02101T	Basic Electrical & Electronics Engineering	3	0	0	3
4	23A03101T	Engineering Graphics	1	0	4	3
5	23A05101T	Introduction to Programming	3	0	0	3
6	23A05102	IT Workshop	0	0	2	1
7	23A56101P	Engineering Physics Lab	0	0	2	1
8	23A02101P	Electrical & Electronics Engineering Workshop	0	0	3	1.5
9	23A05101P	Computer Programming Lab	0	0	3	1.5
10	23A99101	NSS/NCC/Scouts & Guides/Community Service	-	-	1	0.5
Total			**13**	**00**	**15**	**20.5**

B.Tech. – I Year II Semester

S.No.	Course code	Title	L	T	P	Credits
1	23A52201T	Communicative English	2	0	0	2
2	23A51201T	Engineering Chemistry	3	0	0	3
3	23A54201	Differential Equations & Vector Calculus	3	0	0	3
4	23A01201T	Basic Civil & Mechanical Engineering	3	0	0	3
5	23A01202T	Engineering Mechanics	3	0	0	3
6	23A52201P	Communicative English Lab	0	0	2	1
7	23A51201P	Engineering Chemistry Lab	0	0	2	1
8	23A03201	Engineering Workshop	0	0	3	1.5
9	23A03202	Engineering Mechanics Lab	0	0	3	1.5
10	23A99201	Health and wellness, Yoga and Sports	-	-	1	0.5
Total			**14**	**0**	**11**	**19.5**

I Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23A56101) ENGINEERIN GPHYSICS

(Common for all branches of Engineering)

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes:

CO1: Analyze the intensity variation of light due to polarization, interference and diffraction.
CO2: Familiarize with the basics of crystals and their structures.
CO3: Explain fundamentals of quantum mechanics and apply it to one dimensional motion of particles.
CO4: Summarize various types of polarization of dielectrics and classify the magnetic materials.
CO5: Explain the basic concepts of Quantum Mechanics and the band theory of solids.
CO6: Identify the type of semiconductor using Hall effect.

UNIT I Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT III Dielectric and Magnetic Materials

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV Quantum Mechanics and Free electron Theory

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT V Semiconductors

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

Textbooks:

1. A Text book of Engineering Physics, M. N. Avadhanulu, P.G.Kshirsagar& TVS Arun Murthy, S. Chand Publications, 11th Edition 2019.
2. Engineering Physics - D.K.Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Engineering Physics - B.K. Pandey and S. Chaturvedi, Cengage Learning 2021.
2. Engineering Physics - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
3. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press. 2010
4. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).

Web Resources:https://www.loc.gov/rr/scitech/selected-internet/physics.html

I Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23A54101) LINEAR ALGEBRA & CALCULUS
(Common to All Branches of Engineering)

Course Objectives:

- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Develop and use of matrix algebra techniques that are needed by engineers for the practical applications.
CO2: Utilize mean value theorems to real life problems.
CO3: Familiarize with functions of several variables which is useful in optimization.
CO4: Learn important tools of calculus in higher dimensions.
CO5: Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.

UNIT I Matrices

Rank of amatrixbyechel on form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II Eigen values, Eigenvectors and Orthogonal Transformation

Eigen values, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT III Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurintheorems with remainders (without proof), Problems and applications on the above theorems.

UNIT IV Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V Multiple Integrals (Multi variable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Textbooks:

1. Higher Engineering Mathematics, B.S.Grewal,KhannaPublishers,2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley &Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B.Thomas, MauriceD. WeirandJoelHass, Pearson Publishers,2018, 14th Edition.
2. Advanced Engineering Mathematics, R.K.JainandS.R.K.Iyengar,AlphaScienceInternationalLtd.,2021 5th Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, GlynJames, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg,, Pearson publishers, 9thedition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)

I Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23A02101T) BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to All branches of Engineering)

Course Objectives

To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes: After the completion of the course students will be able to

Course Outcomes:

CO1: Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.
CO2: Understand the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.
CO3: Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.
CO4: Analyze different electrical circuits, performance of machines and measuring instruments.
CO5: Evaluate different circuit configurations, Machine performance and Power systems operation.

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:
This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.

Course Outcomes:
CO1: Apply the concept of science and mathematics to understand the working of diodes, transistors, and their applications.
CO2: Explain the characteristics of diodes and transistors.
CO3: Familiarize with the number systems, codes, Boolean algebra and logic gates.

C04: Understand the working mechanism of different combinational, sequential circuits and their role in the digital systems.

UNIT I SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Textbooks:

1. R. L. Boylestad& Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall,
   India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

I Year B.Tech. ME – I Semester

L	T	P	C
1	0	4	3

(23A03101T) ENGINEERING GRAPHICS

(Common to All branches of Engineering)

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes:

CO1: Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
CO2: Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
CO3: Understand and draw projection of solids in various positions in first quadrant.
CO4: Explain principles behind development of surfaces.
CO5: Prepare isometric and perspective sections of simple solids.

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to anotherplane.

UNIT IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings ofobjects including PCB and Transformations using Auto CAD (*Not for end examination*).

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

I Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23A05101T) INTRODUCTION TO PROGRAMMING

(Common to All branches of Engineering)

Course Objectives:

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

Course Outcomes: A student after completion of the course will be able to
CO1: Understand basics of computers, the concept of algorithm and algorithmic thinking.
CO2: Analyse a problem and develop an algorithm to solve it.
CO3: Implement various algorithms using the C programming language.
CO4: Understand more advanced features of C language.
CO5: Develop problem-solving skills and the ability to debug and optimize the code.

UNIT I Introduction to Programming and Problem Solving

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program-Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II Control Structures

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

UNIT III Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

UNIT IV Pointers & User Defined Data types

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT V Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation**.**

Textbooks:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum’s Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A ProblemSolving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

I Year B.Tech. ME – I Semester

L	T	P	C
0	0	2	1

(2305102) IT WORKSHOP

(Common to all branches of Engineering)

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes:

CO1: Perform Hardware troubleshooting.
CO2: Understand Hardware components and inter dependencies.
CO3: Safeguard computer systems from viruses/worms.
CO4: Document/ Presentation preparation.
CO5: Perform calculations using spreadsheets.

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting.

Finally students should demonstrate, to the instructor, how to access the websites and email. If there isno internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

I Year B.Tech. ME – I Semester

L	T	P	C
0	0	2	1

(23A56101P) ENGINEERING PHYSICS LAB
(Common to All Branches of Engineering)

Course Objectives:

To study the concepts of optical phenomenon like interference, diffraction etc., recognize the importance of energy gap in the study of conductivity and Hall effect in semiconductors and study the parameters and applications of dielectric and magnetic materials by conducting experiments.

Course Outcomes: The students will be able to
CO1: Operate optical instruments like travelling microscope and spectrometer.
CO2: Estimate the wavelengths of different colours using diffraction grating.
CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance.
CO4: Evaluate dielectric constant and magnetic susceptibility for dielectric and magnetic materials respectively.
CO5: Calculate the band gap of a given semiconductor.
CO6: Identify the type of semiconductor using Hall effect.

List of Experiments:

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
11. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.

Note: Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode.

References:

- A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

Web Resources

- www.vlab.co.in
- https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

I Year B.Tech. ME – I Semester

L	T	P	C
0	0	3	1.5

(23A02101P) ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP
(Common to All branches of Engineering)

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes:

CO1: Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
CO2: Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
CO3: Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
CO4: Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
CO5: Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
   - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
   - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL

2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING LAB

Course Objectives:

- To impart knowledge on the principles of digital electronics and fundamentals of electron devices& its applications.

Course Outcomes: At the end of the course, the student will be able to
CO1: Identify & testing of various electronic components.
CO2: Understand the usage of electronic measuring instruments.
CO3: Plot and discuss the characteristics of various electron devices.
CO4: Explain the operation of a digital circuit.

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

1. R. L. Boylestad& Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Note: Minimum Six Experiments to be performed.All the experiments shall be implemented using both Hardware and Software.

I Year B.Tech. ME – I Semester

L	T	P	C
0	0	3	1.5

(23A05101P) COMPUTER PROGRAMMING LAB
(Common to All branches of Engineering)

Course Objectives:

The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

Course Outcomes:
CO1: Read, understand, and trace the execution of programs written in C language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers.
CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

UNIT I

WEEK 1
Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:
Tutorial 1: Problem-solving using Computers.
Lab1: Familiarization with programming environment
i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2
Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:
Tutorial 2: Problem-solving using Algorithms and Flow charts.
Lab 1: Converting algorithms/flow charts into C Source code.
Developing the algorithms/flowcharts for the following sample programs
i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

UNIT II

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator' precedence and associativity

i) Evaluate the following expressions.
   a. A+B*C+(D*E) + F*G
   b. A/B*C-B+A*D/3
   c. A+++B---A
   d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:
Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series
i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

UNIT III

WEEK 7:
Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:
Tutorial 7: 1 D Arrays: searching.
Lab 7:1D Array manipulation, linear search
i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

WEEK 8:
Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Matrix problems, String operations, Bubble sort
i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK9:
Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details along with the total.
v) Write a C program to implement realloc()

WEEK 10:
Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:
Tutorial 10: Bitfields, Self-Referential Structures, Linked lists
Lab10 : Bitfields, linked lists
Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK 11:
Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:
Tutorial 11: Functions, call by value, scope and extent,
Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:
Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:
Tutorial 12: Recursion, the structure of recursive calls
Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.

iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13:
Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:
Tutorial 13: Call by reference, dangling pointers
Lab 13: Simple functions using Call by reference, Dangling pointers.
i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK14:
Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:
Tutorial 14: File handling
Lab 14: File operations
i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-line arguments.
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

Textbooks:
1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum' s Outline of Programming with C, McGraw Hill

Reference Books:
1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

I Year B.Tech. ME – I Semester

L	T	P	C
0	0	1	0.5

(23A99101) NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

(Common to All branches of Engineering)

Course Objectives:

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes: After completion of the course the students will be able to

CO1: Understand the importance of discipline, character and service motto.

CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.

CO3: Explore human relationships by analyzing social problems.

CO4: Determine to extend their help for the fellow beings and downtrodden people.

CO5: Develop leadership skills and civic responsibilities.

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT III Community Service

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media-authorities-experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme*Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., “Introduction to Environmental Engineering”, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. “Introduction to Environmental Engineering and Science”, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

I Year B.Tech. ME – II Semester **Course Code:**

L	T	P	C
2	0	0	2

(23A52201T) COMMUNICATIVE ENGLISH

(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, *Communicative English*, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

Course Outcomes:

CO1: Understand the context, topic, and pieces of specific information from social or Transactional dialogues.

CO2: Applygrammaticalstructurestoformulatesentencesandcorrectwordforms.

CO3: Analyzediscoursemarkerstospeakclearlyonaspecifictopicininformaldiscussions.

CO4: Evaluate reading / listening text sand to write summaries based on global – Comprehension of these texts.

CO5: Create a coherent paragraph, essay, and resume.

UNIT I

Lesson: HUMAN VALUES: Gift of Magi **(Short Story)**

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs /small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices -linkers, use of articles and zero article; prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

UNIT III
Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed
Reading: Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

UNIT IV
Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in text stocon vey information, reveal trends /patterns/ relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

UNIT V
Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension.
Writing: Writing structured essays on specific topics.
Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

Textbooks:
1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:
1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.

3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

I Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23A51201T) ENGINEERING CHEMISTRY

(Common to Civil, Chemical, Mechanical Engineering and allied branches)

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of ectro chemistry, polymers, surface chemistry, and cement

.

Course Outcomes: At the end of the course, the students will be able to
CO1: Demonstrate the corrosion prevention methods and factors affecting corrosion.
CO2: Explain the preparation, properties, and applications of thermoplastics & thermo setting, elastomers & conducting polymers.
CO3: Explain calorific values, octane number, refining of petroleum and cracking of oils.
CO4: Explain the setting and hardening of cement.
CO5: Summarize the concepts of colloids, micelle and nanomaterials.

UNIT I Water Technology

Soft and hard water, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen - Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment – Specifications for drinking water, Bureau of Indian Standards(BIS) and World health organization(WHO) standards, Ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electrodialysis.

UNIT II Electrochemistry and Applications

Electrodes –electrochemical cell, Nernst equation, cell potential calculations.
Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.
Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT III Polymers and Fuel Chemistry

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization.
Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC Nylon 6,6 and Bakelite.
Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol rubbers.
Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum,

Octane and Cetane number- alternative fuels- propane, methanol, ethanol and bio fuel-bio diesel.

UNIT IV Modern Engineering Materials

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications
Refractories- Classification, Properties, Factors affecting the refractory materials and Applications.
Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications.
Building materials- Portland Cement, constituents, Setting and Hardening of cement.

UNIT V Surface Chemistry and Nanomaterials

Introduction to surface chemistry, colloids, nanometals and nanometal oxides, micelle formation, synthesis of colloids (Braggs Method), chemical and biological methods of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, adsorption isotherm (Freundlich and Longmuir), BET equation (no derivation) applications of colloids and nanomaterials – catalysis, medicine, sensors, etc.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e,DhanpatRai,2013.
2. Peter Atkins, Juliode Paula and James Keeler, Atkins' Physical Chemistry,10/e,OxfordUniversityPress,2010.

Reference Books:

1. H.F.W. Taylor, Cement Chemistry,2/e,ThomasTelfordPublications,1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman, 1992.
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

I Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23A54201) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to All Branches of Engineering)

Course Objectives:

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real-world applications.

Course Outcomes: At the end of the course, the student will be able to

CO1: Solve the differential equations related to various engineering fields.
CO2: Identify solution methods for partial differential equations that model physical processes.
CO3: Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO4: Estimate the work done against a field, circulation and flux using vector calculus.

UNIT I **Differential equations of first order and first degree**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II **Linear differential equations of higher order (Constant Coefficients)**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III **Partial Differential Equations**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV **Vector differentiation**

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

UNIT V Vector integration

LWithoutegral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

I Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23A01201T) BASIC CIVIL AND MECHANICAL ENGINEERING

(Common to All branches of Engineering)

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

Course Outcomes: On completion of the course, the student should be able to:

CO1: Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.

CO2: Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying.

CO3: Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.

CO4: Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.

CO5: Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

UNIT II

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

UNIT III

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives: The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes: On completion of the course, the student should be able to
CO1: Understand the different manufacturing processes.
CO2: Explain the basics of thermal engineering and its applications.
CO3: Describe the working of different mechanical power transmission systems and power plants.
CO4: Describe the basics of robotics and its applications.

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.
Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.
Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants.
Mechanical Power Transmission - Belt Drives, Chain, Ropedrives, Gear Drives and their applications.
Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

1. AppuuKuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

I Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23A01202T) ENGINEERING MECHANICS
(Common to Civil, Mechanical Engineering & Allied branches)

Course Objectives:

- To get familiarized with different types of force systems.
- To draw accurate free body diagrams representing forces and moments acting on a body to analyze the equilibrium of system of forces.
- To teach the basic principles of center of gravity, centroid and moment of inertia and determine them for different simple and composite bodies.
- To apply the Work-Energy method to particle motion.
- To understand the kinematics and kinetics of translational and rotational motion of rigid bodies.

Course Outcomes: On Completion of the course, the student should be able to
CO1: Understand the fundamental concepts in mechanics and determine the frictional forces for bodies in contact.
CO2: Analyze different force systems such as concurrent, coplanar and spatial systems and calculate their resultant forces and moments.
CO3: Calculate the centroids, center of gravity and moment of inertia of different geometrical shapes.
CO4: Apply the principles of work-energy and impulse-momentum to solve the problems of rectilinear and curvilinear motion of a particle.
CO5: Solve the problems involving the translational and rotational motion of rigid bodies.

UNIT I
Introduction to Engineering Mechanics– Basic Concepts. Scope and Applications
Systems of Forces: Coplanar Concurrent Forces– Components in Space–Resultant–Moment of Force and its Application –Couples and Resultant of Force Systems.
Friction: Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction.

UNIT II
Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorm, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.
Principle of virtual work with simple examples

UNIT III
Centroid: Centroids of simple figures (from basic principles)–Centroids of Composite Figures.
Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of

gravity of composite bodies, Pappus theorems.
Area Moments of Inertia: Definition–Polar Momen to fInertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.
Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies.

UNIT IV

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics –D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method.

UNIT V

Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method.

Textbooks:

1. Engineering Mechanics, S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., , McGraw Hill Education 2017. 5th Edition.
2. Engineering Mechanics, P.C.Dumir- S.Sengupta and Srinivas V veeravalli , University press. 2020. First Edition.
3. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age international publications 2018. 4th Edition.

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education. 2017. First Edition.
2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., PHI, 2002. 4th Edition.
3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L. G. Kraige., John Wiley, 2008. 6th Edition.
4. Introduction to Statics and Dynamics, Basudev Battachatia, Oxford University Press, 2014. Second Edition
5. Engineering Mechanics: Statics and Dynamics, Hibbeler R.C.,Pearson Education, Inc., New Delhi, 2022, 14th Edition

I Year B.Tech. ME – II Semester

L	T	P	C
0	0	2	1

(23A52201P) COMMUNICATIVE ENGLISH LAB

(Common to All Branches of Engineering)

Course Objectives:

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

Course Outcomes:

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills.
CO2: Apply communication skills through various language learning activities.
CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable divisionfor better listening and speaking comprehension.
CO4: Evaluate and exhibit professionalism in participating in debates and group discussions.
CO5: Create effective Course Objectives:

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

- Walden Infotech
- Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta- Sharma. *Technical Communication*. Oxford Press.2018.
2. TaylorGrant:*EnglishConversationPractice*,TataMcGraw-HillEducationIndia,2016
3. Hewing's, Martin. Cambridge *Academic English*(B2).CUP,2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed),Kindle, 2013

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

I Year B.Tech. ME – II Semester

L	T	P	C
0	0	2	1

(23A51201P) ENGINEERING CHEMISTRY LAB

(Common to Civil, Chemical, Mechanical Engineering & allied branches)

Course Objectives:

- To verify the fundamental concepts with experiments

Course Outcomes: At the end of the course, the students will be able to
CO1: Determine the cell constant and conductance of solutions.
CO2: Prepare advanced polymer materials.
CO3: Determine the physical properties like surface tension, adsorption and viscosity.
CO4: Estimate the Iron and Calcium in cement.
CO5: Calculate the hardness of water.

List of Experiments:

1. Determination of Hardness of a groundwater sample.
2. Estimation of Dissolved Oxygen by Winkler's method
3. Determination of Strength of an acid in Pb-Acid battery
4. Preparation of a polymer (Bakelite)
5. Determination of percentage of Iron in Cement sample by colorimetry
6. Estimation of Calcium in port land Cement
7. Preparation of nanomaterials by precipitation method.
8. Adsorption of acetic acid by charcoal
9. Determination of percentage Moisture content in a coal sample
10. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
11. Determination of Viscosity of lubricating oil by Redwood Viscometer 2
12. Determination of Calorific value of gases by Junker's gas Calorimeter

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

I Year B.Tech. ME – II Semester

L	T	P	C
0	0	3	1.5

(23A03201) ENGINEERING WORKSHOP

(Common to All branches of Engineering)

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Course Outcomes:

CO1: Identify workshop tools and their operational capabilities.
CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
CO3: Apply fitting operations in various applications.
CO4: Apply basic electrical engineering knowledge for House Wiring Practice

SYLLABUS

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint b) Mortise and Ten on joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) God own lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

I Year B.Tech. ME – II Semester

L	T	P	C
0	0	3	1.5

(23A03202) ENGINEERING MECHANICS LAB
(Mechanical Engineering & allied branches)

Course Objectives: The students completing the course are expected to:

- Verify the Law of Parallelogram and Triangle of Forces.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Analyse the system of Pulleys and Moment of Inertia of Compound Pendulum and Flywheel.

Course Outcomes:

CO1: Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.
CO2: Verify Law of Polygon of forces and Law of Moment using force polygon and bell crank lever.
CO3: Determine the Centre of gravity and Moment of Inertia of different configurations.
CO4: Verify the equilibrium conditions of a rigid body under the action of different force systems.

Students have to perform any 10 of the following Experiments:

List of Experiments: Verification of Law of Parallelogram of Forces.

1. Verification of Law of Triangle of Forces.
2. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.
3. Determination of coefficient of Static and Rolling Frictions
4. Determination of Centre of Gravity of different shaped Plane Lamina.
5. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam.
6. Study of the systems of pulleys and draw the free body diagram of the system.
7. Determine the acceleration due to gravity using a compound pendulum.
8. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
9. Determine the Moment of Inertia of a Flywheel.
10. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

I Year B.Tech. CE – II Semester

L	T	P	C
0	0	1	0.5

(23A99201) HEALTH AND WELLNESS, YOGA AND SPORTS

(Common to All branches of Engineering)

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to

- **CO1**: Understand the importance of yoga and sports for Physical fitness and sound health.
- **CO2:** Demonstrate an understanding of health-related fitness components.
- **CO3:** Compare and contrast various activities that help enhance their health.
- **CO4:** Assess current personal fitness levels.
- **CO5:** Develop Positive Personality

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball,

Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
Practicing general and specific warm up, aerobics

ii) Practicing cardio respiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.

A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

B.TECH.-MECHANICAL ENGINEERING
II YEAR COURSE STRUCTURE & SYLLABI

B.Tech.– II Year I Semester

S.No.	Course code	Title	L	T	P	Credits
1	23A54303	Numerical Methods &Transform Techniques	3	0	0	3
2	23A52301	UniversalHumanValues– UnderstandingHarmony& Ethical human conduct	2	1	0	3
3	23A03301	Thermodynamics	2	0	0	2
4	23A03302	Mechanics of Solids	3	0	0	3
5	23A03303	Material Science and Metallurgy	3	0	0	3
6	23A03304	Mechanics of Solids and Materials Science Lab	0	0	3	1.5
7	23A03305	Computer-Aided Machine Drawing	0	0	3	1.5
8	23A03306	Embedded Systems and IoT	0	0	2	1.0
9	23A05304	Python programming	0	1	2	2
10	23A99301	Environmental Science	2	0	0	-
		Total	**15**	**2**	**10**	**20**

B.Tech. II Year II Semester

S.No.	Course code	Title	L	T	P	Credits
1	23A52402d	Industrial Management	2	0	0	2
2	23A54403	Complex Variables, Probability and Statistics	3	0	0	3
3	23A03401T	Manufacturing processes	3	0	0	3
4	23A03402T	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	23A03403	Theory of Machines	3	0	0	3
6	23A03402P	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	23A03401P	Manufacturing processes Lab	0	0	3	1.5
8	23A52403	Soft Skills	0	1	2	2
9	23A99401	DesignThinking&Innovation	1	0	2	2
		Total	**15**	**1**	**10**	**21**
MandatoryCommunityServiceProjectInternshipof 08weeksduration during summer Vacation						

II Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23A54303) NUMERICAL METHODS &TRANSFORM TECHNIQUES(MECH)

Course Outcomes:

COs	Statements	Blooms level
CO1	Apply numerical methods to solve algebraic and transcendental equations	L2, L3
CO2	Derive interpolating polynomials using interpolation formulae	L3, L5
CO3	Solve differential and integral equations numerically	L3
CO4	Understand the use of Laplace transform in system modeling, digital signal processing, process control, solving Boundary Value Problems.	L2, L3
CO5	Apply Fourier series and Fourier transform in communication theory and signal analysis, image processing and filters, data processing and analysis, solving partial differential equations for problems on gravity.	L3,L5

UNITI Solution of Algebraic & Transcendental Equations

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson methodSystem of Algebraic equations: Gauss Elimination, Jacoby and Gauss Siedal method.

UNIT II Interpolation

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.

UNIT III Solution of Initial value problems to Ordinary differential equations

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).

UNIT IV Laplace Transforms

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, transforms of derivatives and integrals – Unit step function – Second shifting theorem– Convolution theorem – Laplace transform of Periodic function.

UNIT V Fourier seriesand Fourier transforms

Fourier series: Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series -Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions

Fourier transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem.

Textbooks:

1. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.
2. B. S. Grewal,Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition

Reference Books:

1. ErwinKreyszig, Advanced Engineering Mathematics, John Wiley &Sons, 2018, 10th Edition.
2. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd.,2021 5th Edition(9th reprint).
3. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publications,2014, Third Edition (Reprint 2021)
4. Alan Jeffrey, Advanced Engineering Mathematics, Elsevier

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma05/preview
3. http://nptel.ac.in/courses/111105090

II Year B.Tech. ME – I Semester

L	T	P	C
2	1	0	3

(23A52301) UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT
(Common to All Branches of Engineering)

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

COURSE OUTCOMES: At the end of the course, students will be able to		**Blooms Level**
CO1	Define the terms like Natural Acceptance, Happiness and Prosperity	L1, L2
CO2	Identify one's self, and one's surroundings (family, society nature)	L1, L2
CO3	Apply what they have learnt to their own self in different day-to-day settings in real life	L3
CO4	Relate human values with human relationship and human society.	L4
CO5	Justify the need for universal human values and harmonious existence	L5
CO6	Develop as socially and ecologically responsible engineers	L3, L6

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:
Textbook and Teachers Manual
a. The Textbook
R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
b. The Teacher’s Manual
R R Gaur, R Asthana, G P Bagaria,Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books
1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad

12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:
Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.
Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.
It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.
Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources
1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf

2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf

3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf

4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf

5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf

6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf

7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf

8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385

https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II Year B.Tech. ME – I Semester

L	T	P	C
2	0	0	2

(23A03301) THERMODYNAMICS

Course Objectives

- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
- Explain relationships between properties of matter and basic laws of thermodynamics.
- Teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- Introduce the concept of available energy for maximum work conversion.
- Provide fundamental concepts of Refrigeration and Psychrometry.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Explain the importance of thermodynamic properties related to conversion of heat energy into work.	L3
CO2	Apply the Zeroeth and First Law of Thermodynamics.	L3
CO3	Understand Second Law of Thermodynamics.	L2
CO4	Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, Phase Transformations	L4
CO5	Evaluate the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads.	L5

Unit - I

Introduction: Basic Concepts : System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility

Unit -II

Energy in State and in Transition, Types, Work and Heat, Point and Path function.Zeroeth Law of Thermodynamics – PMM-I, Joule's Experiment – First law of Thermodynamics and applications. Limitations of the First Law – Enthalpy, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.

Unit - III

Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

Unit - IV

Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.

Unit – V

Introduction to Refrigeration: working of Air, Vapourcompression,VCR system Components, COP Refrigerants.

Introduction to Air Conditioning**:** Psychrometric properties & processes – characterization of sensible and latent heat loads – load concepts of SHF.

Requirements of human comfort and concept of effective temperature- comfort chart – comfort air conditioning, and load calculations.

Textbooks:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009.

Reference Books

1. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e,Prentice Hall, 1995.
2. Y.A.Cengel&M.A.Boles ,Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010.
3. P.Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011.
4. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021.

Online Learning Resources:

- https://www.edx.org/learn/thermodynamics.
- https://archive.nptel.ac.in/courses/112/106/112106310.
- https://www.youtube.com/watch?v=7NI5P4KqrAs&t=1s
- https://kp.kiit.ac.in/pdf_files/02/Study-Material_3rd-Semester_Winter_2021_Mechanical-Engg.-_Thermal-Engineering-1_Abhijit-Samant.pdf
- https://www.coursera.org/learn/thermodynamics-intro

II Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23A03302) MECHANICS OFSOLIDS

Course Objectives: The objectives of the course are to

- Understand the behaviour of basic structural members subjected to uniaxial and bi axial loads.
- Applytheconceptofstress andstrainto analyse anddesignstructuralmembers and machine parts under axial, shear and bending loads, moment and torsional moment.
- Studentswilllearnallthemethodsto analyse beams,columns,framesfornormal,shear,andtorsionstresses andtosolvedeflectionproblemsinpreparationforthedesignofsuchstructuralcomponents.Studentsareabletoanalysebeamsanddrawcorrectandcompleteshearandbendingmomentdiagramsfor beams.
- Studentsattainadeeperunderstandingoftheloads,stresses,andstrains actingonastructureandtheirrelationsinthe elasticbehavior
- DesignandanalysisofIndustrialcomponentslikepressurevessels.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components	L1
CO2	Analyse beams and draw correct and complete shear and bending moment diagrams for beams.	L4
CO3	Apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, and moments.	L3
CO4	Model &Analyze the behavior of basic structural members subjected to various loads	L4
CO5	Design and analysis of Industrial components like pressure vessels.	L6

UNIT– I

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses & strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT–II

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simplysupported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads andcombination of these loads – Point of contra flexure – Relation between S.F., B.M and rate ofloadingata sectionofabeam.

UNIT–III

FLEXURAL STRESSES : Theory of simple bending, Derivation of bending equation, Determination of bending stresses – section modulus of rectangular, circular, I and T sections– Design of simple beam sections.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I and T sections.

UNIT–IV

DEFLECTION OF BEAMS : Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, UDL and UVL. Mohr's theorem and Moment area method – application to simple cases.

TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT– V

THIN AND THICK CYLINDERS: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders– Thin spherical shells. Wire wound thin cylinders. Lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

COLUMNS:

Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula

Text Books:

1. GH Ryder,Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.
2. B.C. Punmia,Strength of materials,10/e, Lakshmi publications Pvt.Ltd, New Delhi, 2018.

Reference Books:

1. Gere &Timoshenko,Mechanics of materials, 2/e, CBS publications, 2004.
2.U.C.Jindal, Strength of Materials, 2/e, Pearson Education, 2017.
3.Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
4. Andrew Pytel and Ferdinand L. Singer,Strength of Materials,4/e, Longman Pulications, 1990.
5. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc19_ce18/preview.
- https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6.
- https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s
- https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204
- https://www.coursera.org/learn/mechanics-1
- https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior
- https://archive.nptel.ac.in/courses/112/107/112107146/

II Year B.Tech. ME – I Semester

L	T	P	C
3	0	0	3

(23A03303) MATERIALSCIENCE&METALLURGY

Course Objective:

- Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.
- Study the behavior of ferrous and non ferrous metals and alloys and their application in different domains
- Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
- Grasp the methods of making of metal powders and applications of powder metallurgy
- Comprehend the properties and applications of ceramic, composites and other advanced methods

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.	L2
CO2	Study the behavior of ferrous and non-ferrous metals and alloys and their application in different domains.	L1
CO3	Understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.	L2
CO4	Grasp the methods of making of metal powders and applications of powder metallurgy.	L3
CO5	Comprehend the properties and applications of ceramic, composites and other advanced methods.	L4

UNIT– I

StructureofMetalsandConstitutionofalloys: Crystallization of metals, Packing Factor - SC, BCC, FCC& HCP-line density, plane density.Grain and grain boundaries, effect of grain boundaries–determinationofgrainsize.
Imperfections, SlipandTwinning.
Necessityof alloying,typesof solidsolutions,HumeRothery'srules,intermediatealloyphases,andelectroncompounds
Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoidreactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe_3C.

UNIT–II

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron,grey castiron,Spheriodalgraphitecastiron,Alloycastiron.Classificationofsteels,structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels,toolanddiesteels.
Non-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT–III
Heat treatment of Steels: Effect of alloying elements on Fe-Fe_3C system, annealing, normalizing,hardening, TTT diagrams, tempering, hardenability, surface - hardening methods, age hardening treatment, Cryogenic treatment.

UNIT–IV
Powder Metallurgy: Basic processes- Methods of producing metal powders- milling atomization- Granulation-Reduction-Electrolytic Deposition. Compacting methods – Sintering - Methods of manufacturing sintered parts. Secondary operations, Applications of powder metallurgical products.

UNIT– V
Ceramic and Advanced materials: Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, manufacturing methods, particle reinforced composites, fiber reinforced composites, PMC, MMC, CMC and CCCs. Introduction to Nanomaterials and smart materials.

Text Books:
1. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
2. Donald R.Askeland, Essentials of Materials science and Engineering, 4/e, CL Engineering publications, 2018.

Reference Books:
1. Dr.V.D.kodgire, Material Science and Metallurgy, 39/e, Everest Publishing House, 2017.
2. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
3. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.
5. Yip-Wah Chung, Introduction to Material Science and Engineering, 2/e, CRC Press, 2022.
6. A V K Suryanarayana, Material Science and Metallurgy, B S Publications, 2014.
7. U. C. Jindal, Material Science and Metallurgy, 1/e, Pearson Publications, 2011.

Online Learning Resources:
- https://archive.nptel.ac.in/courses/113/106/113106032/
- https://www.edx.org/learn/mechanics/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-3-time-dependent-behavior.
- https://www.youtube.com/watch?v=9Sf278j1GTU
- https://www.coursera.org/learn/fundamentals-of-materials-science
- https://www.coursera.org/learn/material-behavior.

II Year B.Tech. ME – I Semester

L	T	P	C
0	0	3	1.5

(23A03304) MECHANICS OFSOLIDS &MATERIAL SCIENCELAB

Course Objective:

- Evaluate the values of yield stress, ultimate stress and bending stress of the given specimen under tension test and bending test
- Conduct the torsion test to determine the modulus of rigidity of given specimen.
- Justify the Rockwell hardness test over with Brinell hardness and measure the hardness of the given specimen.
- Examine the stiffness of the open coil and closed coil spring and grade them.
- Analyze the microstructure and characteristics of ferrous and non ferrous alloy specimens.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the stress strain behavior of different materials.	L2
CO2	Evaluate the hardness of different materials.	L4
CO3	Explain the relation between elastic constants and hardness of materials.	L1
CO4	Identify various microstructures of steels and cast irons.	L3
CO5	Evaluate hardness of treated and untreated steels.	L4

NOTE: Any 6 experiments from each section A and B.

A) MECHANICSOFSOLIDSLAB:

1. Tensile test
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
   a) Brinell's hardness test
   b) Rockwell hardness test
   c) Vickers hardness test
5. Test on springs
6. Impact test
   a) Charpy test
   b) Izod test
7. Punch shear test
8. Liquid penetration test

B) MATERIAL SCIENCELAB:

1. Preparation and study of the Microstructure of pure metals.

2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels.
3. Study of the Microstructures of Cast Irons.
4. Study of the Microstructures of Non-Ferrous alloys.
5. Study of the Microstructures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.

Virtual lab:

1. To investigate the principal stresses σa and σb at any given point of a structural element or machine component when it is in a state of plane stress. (https://virtual-labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html)
2. To find the impact resistance of mild steel and cast iron.(https://sm-nitk.vlabs.ac.in/exp/izod-impact-test).
3. To find the impact resistance of mild steel.(https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/index.html)
4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test)
5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test).

II Year B.Tech. ME – I Semester

L	T	P	C
0	0	3	1.5

(23A03305) COMPUTER-AIDED MACHINE DRAWING

Course Objectives

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D and 3D assembly drawings and Familiarize with limits, fits, and tolerances inmating components

Course Outcomes:

COs	Statements	Blooms Level
CO1	Demonstrate the conventional representations of materials and machine components.	L3
CO2	Model riveted, welded and key joints using CAD system.	L6
CO3	Create solid models and sectional views of machine components.	L6
CO4	Generate solid models of machine parts and assemble them.	L5
CO5	Translate 3D assemblies into 2D drawings.	L6

The following are to be done by any 2D software package

Conventional representation of materials and components:
Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.
Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.
Welded joints: Lap joint and T joint with fillet, butt joint with conventions.
Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.
Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's' coupling.

The following exercises are to be done by any 3D software package:

Sectional views:
Creating solid models of complex machine parts and sectional views.

Assembly drawings:(Any four of the following using solid model software)
Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling.

Production drawing:
Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Textbooks:

1 Machine Drawing byK.L.Narayana, P.Kannaiah and K.Venkat Reddy, New Age International Publishers, 3/e, 2014
2 Machine drawing by N.Sideshwar, P. Kannaiah, V.V.S.Sastry, TMH Publishers. 2014.

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.

Online Learning Resources:

- https://eeedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf
- https://archive.nptel.ac.in/courses/112/105/112105294/
- https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete
- https://www.youtube.com/watch?v=0bQkS3_3Fq4

II Year B.Tech. ME – I Semester

L	T	P	C
0	0	2	1

(23A03306) EMBEDDED SYSTEMS & IoT

Course Objectives:

- To comprehend Microcontroller-Transducers Interface techniques
- To establish Serial Communication link with Arduino
- To analyse basics of SPI interface.
- To interface Stepper Motor with Arduino
- To analyse Accelerometer interface techniques
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Comprehend Microcontroller-Transducers Interface techniques.	L4
CO2	Establish Serial Communication link with Arduino	L6
CO3	Analyse basics of SPI interface.	L4
CO4	Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor.	L2
CO5	Realize the revolution of internet in mobile devices, cloud and sensor networks	L3

Embedded Systems Experiments: (Any 5 experiments from the following)

1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal.

COMPONENTS/ BOARDS: 1. Arduino Duemilanove Board 2. Arduino Software IDE.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
4. Embedded Systems-Lyla B.Das-Pearson Publications,2013.

Internet of Things Experiments: (Any 5 experiments from the following)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace
3. and debug Python code on the device.
4. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED

functionality.

5. Raspberry Pi interact with online services through the use of public APIs and SDKs.
6. Study and Install IDE of Arduino and different types of Arduino.
7. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
8. Calculate the distance using distance sensor Using Arduino.
9. Basic LED functionality Using Arduino and Node MCU.
10. Calculate the moisture content in the soil using Arduino and Node MCU.
11. Calculate the distance using distance sensor Using Node MCU.
12. Basic LED functionality Using Node MCU.

II Year B.Tech. ME – I Semester

L	T	P	C
0	1	2	2

(23A05304) PYTHON PROGRAMMING
(SKILL ENHANCEMENT COURSE)

Course Objectives:
The main objectives of the course are to
- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

Course Outcomes:
After completion of the course, students will be able to
- Classify data structures of Python (L4)
- Apply Python programming concepts to solve a variety of computational problems (L3)
- Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3)
- Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
- Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)
- Propose new solutions to computational problems (L6)

UNTI-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.
Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.
Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:
1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operatorsiv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II: Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables,

Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.
Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
    i. Addition ii. Insertion iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT-IV:Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V: Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.

25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

Text Books:

1. ArsheepBahga&Vijay Madisetti, Internet of Things - A Hands-on Approach, 1/e, Orient Blackswan Private Limited - New Delhi, 2015.
2. Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,.

Online Learning Sources

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
3. https://archive.nptel.ac.in/courses/108/105/108105057/
4. https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin-embedded-systems-shape-the-world-microcontroller-input-output?index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2FOutput&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems
5. https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4&linked_from=autocomplete&c=autocomplete
6. https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257-a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch
7. Virtual Labs - http://vlabs.iitkgp.ac.in/rtes/
8. Virtual Labs -https://cse02-iiith.vlabs.ac.in/
9. Virtual Labs - https://iotvirtuallab.github.io/vlab/Experiments/index.html

II Year B.Tech. ME – I Semester

L	T	P	C
2	0	0	0

(23A99301) ENVIRONMENTAL SCIENCE

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

UNIT I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

References:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.
3. https://www.coursera.org/learn/python-for-applied-data-science-ai
4. https://www.coursera.org/learn/python?specialization=python#syllabus

II Year B.Tech. ME – II Semester

L	T	P	C
2	0	0	2

(23A52402d) INDUSTRIAL MANAGEMENT

Course Objectives: The objectives of the course are to

- Introducethescopeandroleofindustrialengineeringandthetechniquesforoptimaldesignoflayouts
- Illustrate how work study is used to improve productivity
- Explain TQM and quality control techniques
- Introduce financial management aspects and
- Discuss human resource management and value analysis.

Course Outcomes:

COs	Statements	BloomsLevel
CO1	Learn about how to design the optimal layout	L1
CO2	Demonstrate work study methods	L3
CO3	Explain Quality Control techniques	L2
CO4	Discuss the financial management aspects	L3
CO5	Understand the human resource management methods.	L2

UNIT– I

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of anindustrial engineer, quantitativetoolsofIEandproductivitymeasurement.Conceptsofmanagement,importance,functionsofmanagement, scientific management, Taylor’s principles, Fayol’s principles ofmanagement.

PLANTLAYOUT: Factorsgoverningplantlocation,typesofproductionlayouts,advantagesanddisadvantagesofprocesslayoutandproductlayout,applications,quantitativetechniquesforoptimaldesignof layouts.

UNIT–II

WORK STUDY: Importance, types of production, applications, work study, method study and timestudy,worksampling,PMTS,micro-motionstudy,ratingtechniques,MTM,workfactorsystem,principlesofErgonomics,flowprocesscharts,stringdiagramsandTherbligs.

UNIT–III

STATISTICAL QUALITY CONTROL: Quality control, Queuing assurance and its importance, SQC,attribute sampling inspection with single and double sampling, Control charts – $\bar{X}$ and R –charts X and Scharts and their applications, simple numerical examples.

TOTALQUALITYMANAGEMENT:Elements of TQM – Continuous Improvement – zerodefectconcept,qualitycircles,implementation,applications,ISOqualitysystems.SixSigma–definition,basic concepts.

UNIT– IV

FINANCIAL MANAGEMENT: Scope and nature of financial management, Sources of finance, Management of working capital, estimation of working capital requirements, budget and budgetary control, Capital budgeting – Nature of InvestmentDecisions– InvestmentEvaluationcriteria-NPV,IRR,PI,PaybackPeriod,andARR,numericalproblems.

UNIT–V

HUMANRESOURCEMANAGEMENT: Conceptofhumanresourcemanagement,personnelmanagement and industrial relations, functions of personnel management, Job-evaluation, its importanceandtypes, merit rating, quantitative methods, wage incentive plans, andtypes.

VALUE ANALYSIS: Value engineering, implementation procedure, enterprise resource planning andsupply chain management.

Text Books:

1. O.PKhanna,IndustrialEngineeringandManagement,DhanpatRaiPublications(P)Ltd.
2. MartandTelsang,IndustrialEngineeringandProductionManagement,S.Chand &CompanyLtd.New Delhi

ReferenceBooks:

1. Bhattacharya DK, Industrial Management, S.Chand, publishers.
2. J.G Monks, Operations Management, 3/e, McGraw Hill Publishers.
3. T.R.Banga,S.C.Sharma,N.K.Agarwal,IndustrialEngineeringandManagementScience, KhannaPublishers.
4. Koontz O’Donnell, Principles of Management, McGraw Hill Publishers.
5. R.C.Gupta, Statistical Quality Control, Khanna Publishers.
6. NVS Raju, Industrial Engineering and Management, Cengage India Private Limited.

Online Learning Sources

- https://onlinecourses.nptel.ac.in/noc21_me15/preview
- https://onlinecourses.nptel.ac.in/noc20_mg43/preview
- https://www.edx.org/learn/industrial-engineering
- https://youtube.com/playlist?list=PL299B5CC87110A6E7&si=TghLCbEobuxjEaXi
- https://youtube.com/playlist?list=PLbjTnj-t5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX_5RG69hS3v2ll

II Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23A54403) COMPLEX VARIABLES, PROBABILITY AND STATISTICS

Course Outcomes:

COs	Statements	Blooms level
CO1	Analyze limit, continuity and differentiation of functions of complex variablesand Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.	L2, L3
CO2	Understand Cauchy theorem, Cauchy integral formulas and apply these to evaluate complex contour integrals. Classify singularities and poles; find residues and evaluate complex integrals using the residue theorem.	L3, L5
CO3	Apply Probability theory to find the chances of happening of events.	L3
CO4	Understand various probability distributions and calculate their statistical constants.	L2, L3
CO5	Analyze to test various hypotheses included in theory and types of errors for large samples.	L3, L5

UNITI : Complex Variable – Differentiation

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

UNIT II Complex Variable – Integration

Line integral-Contour integration, Cauchy’s integral theorem(Simple Case), Cauchy Integral formula, Power series expansions: Taylor’s series, zeros of analytic functions, singularities, Laurent’s series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integralinvolving sine and cosine.

UNIT III: Probability theory

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye’s theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation

UNIT IV Random variables & Distributions

Random variables (discrete and continuous), probability density functions, properties, mathematical expectation Probability distribution - Binomial, Poisson approximation to the binomial distribution, Normal distribution and their properties

UNITV Estimation and Testing of hypothesis, large sample tests

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Textbooks:

1. B.S.Grewal,HigherEngineeringMathematics, KhannaPublishers,2017, 44th Edition

2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.

ReferenceBooks:

1. R.K.JainandS.R.K.Iyengar,AdvancedEngineeringMathematics,AlphaScienceInternationalLtd.,2021 5th Edition(9th reprint).
2. B.V.Ramana, Higher Engineering Mathematics, Mc Graw Hill publishers
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ma50/preview
2. https://archive.nptel.ac.in/courses/111/106/111106111/

II Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23A03401T) MANUFACTURING PROCESSES

Course Objective: The objectives of the course are to

- Know the working principle of different metal casting processes and gating system.
- Classify the welding processes, working of different types of welding processes and welding defects.
- Know the nature of plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- Understand the principles of forging, tools and dies, working of forging processes.
- Know about the Additive manufacturing.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Design the patterns and core boxes for metal casting processes	L6
CO2	Understand the different welding processes	L2
CO3	Demonstrate the different types of bulk forming processes	L3
CO4	Understand sheet metal forming processes	L2
CO5	Learn about the different types of additive manufacturing processes	L2

UNIT– I

Casting: Steps involved in making a casting – Advantage of casting and its applications.Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowancesand their construction, Molding, differenttypes of cores , Principles of Gating, Risers,casting design considerations.Methods of melting and types of furnaces, Solidification of castings and casting defects- causes and remedies. Basic principlesand applications of special casting processes - Centrifugal casting,Die casting,Investmentcastingandshellmolding.

UNIT–II

Welding:Classification of welding processes, types of welded joints and their characteristics,Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principlesof Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG&MIGwelding.Electro–slagwelding.

Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding;Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering &Brazing.

Heat affected zones in welding; pre & post heating, welding defects –causesandremedies.

UNIT–III

Bulk Forming: Plastic deformation in metals and alloys-recovery, recrystallization and grain growth.

Hotworking and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging-TypesofForging,forging defects and remedies; Rolling – fundamentals, types of rolling mills and products, Forces in rollingand power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion,Hydrostatic extrusion;Wire drawingandTubedrawing.

UNIT– IV

Sheetmetalforming-Blankingandpiercing,Forcesandpowerrequirementintheseoperations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining,Spinning,Types ofpresses andpresstools.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming,Electrohydraulicforming,rubberpadforming,advantagesandlimitations.

UNIT -V

Additive manufacturing - Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, VAT photopolymerization AM Processes,Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications

Textbooks:

1. Kalpakjain S and Steven R Schmid,Manufacturing Processes for Engineering Materials, 5/e, Pearson Publications, 2007.
2. P.N. Rao,Manufacturing Technology -Vol I, 5/e, McGraw Hill Education, 2018.

Reference Books:

1. A.Ghosh&A.K.Malik, Manufacturing Science, East West Press Pvt. Ltd, 2010.
2. Lindberg and Roy, Processes and materials of manufacture, 4/e, Prentice Hall India Learning Private Limited, 1990.
3. R.K. Jain, Production Technology, Khanna Publishers, 2022.
4. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.
5. H.S. Shaun, Manufacturing Processes, 1/e, Pearson Publishers, 2012.
6. WAJ Chapman , Workshop Technology, 5/e, CBS Publishers&DistributorsPvt.Ltd, 2001.
7. Hindustan Machine Tools, Production Technology, Tata McGraw Hill Publishers, 2017.
8. Ian Gibson, David W Rosen, Brent Stucker., Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, 2/e, Springer, 2015.

Online Learning Resources:

- https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes
- https://onlinecourses.nptel.ac.in/noc21_me81/preview
- www.coursera.org/learn/introduction-to-additive-manufacturing-processessera
- https://archive.nptel.ac.in/courses/112/103/112103263/
- https://elearn.nptel.ac.in/shop/nptel/principles-of-metal-forming-technology/?v=c86ee0d9d7ed

II Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23A03402T) FLUIDMECHANICS & HYDRAULIC MACHINES

Course Objectives: The students completing this course are expected to

- Understand the properties offluids, manometry,hydrostatic forcesactingondifferentsurfaces
- Understand the kinematic and dynamic behavior through various laws of fluids like continuity, Euler's,Bernoulli'sequations,energyandmomentumequations.
- Understand the theory of boundary layer, working and performance characteristics of various hydraulicmachineslikepumps andturbines.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the basic concepts of fluid properties.	L2
CO2	Estimate the mechanics of fluids in static and dynamic conditions.	L5
CO3	Apply the Boundary layertheory, flow separation and dimensional analysis.	L3
CO4	Estimate the hydrodynamicforcesofjetonvanesindifferentpositions.	L5
CO5	Understand the workingPrinciplesandperformanceevaluationofhydraulicpumpandturbines.	L2

UNITI

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and itssignificance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure,Measurement of pressure – Manometers - Piezometer, U-tube, inverted and differential manometers.Pascal's&hydrostatic laws.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation ofmetacenterheight.Stabilityanalysisandapplications.

UNITII

Fluidkinematics: Introduction,flowtypes.Equationofcontinuityforonedimensionalflow,circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function andvelocity potential function, differences and relation between them. Condition for irrotational flow, flownet,sourceandsink,doubletandvortexflow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a streamline,momentumequationandits applications,force onpipebend.

Closedconduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipesinseriesandpipesinparallel-totalenergyline-hydraulicgradientline.

UNITIII

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum andenergy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluffbodyanditsapplications,basicconceptsofvelocityprofiles.

Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization ofequations,Methodofrepeatingvariables andBuckinghamPiTheorem.

UNITIV

Basics ofturbo machinery:hydrodynamicforce ofjets on stationary and movingflat,inclined,andcurvedvanes,jetstrikingcentrallyandattip,velocitydiagrams,workdoneandefficiency,flowOverradialvanes.

HydraulicTurbines:classificationofturbines,impulseandreactionturbines,Peltonwheel,Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – drafttube-theory-functions andefficiency.

UNITV

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristiccurves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.Hydraulic systems- hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors andoscillators.Advantages,limitationsandapplications.

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies-specific speed- pumps in series and parallel-performance characteristic curves, cavitation & NPSH.**Reciprocatingpumps:**Working,Discharge,slip,indicatordiagrams.

Textbooks:

1. Y.A.Cengel,J.M.Cimbala, Fluid Mechanics,Fundamentalsand Applications,6/e,McGraw Hill Publications, 2019.
2. Dixon,Fluid Mechanics and Thermodynamics of Turbomachinery,7/e, Elsevier Publishers, 2014.

ReferenceBooks:

1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. RKBansal, FluidMechanicsandHydraulicMachines, 10/e,LaxmiPublications(P)Ltd, 2019.
3. Rajput, FluidMechanicsandHydraulicMachines, S Chand & Company, 2016.
4. D.S.Kumar,FluidMechanicsandFluidPowerEngineering, S K Kataria &Sons, 2013.
5. D.RamaDurgaiah,FluidMechanicsandMachinery,1/e, NewAgeInternational, 2002.

Online Learning Resources:

- https://archive.nptel.ac.in/courses/112/105/112105206/
- https://archive.nptel.ac.in/courses/112/104/112104118/
- https://www.edx.org/learn/fluid-mechanics
- https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in
- www.coursera.org/learn/fluid-powerera

II Year B.Tech. ME – II Semester

L	T	P	C
3	0	0	3

(23A03403) THEORY OF MACHINES

Course Objectives: The objectives of the course are to make the students learn about

- Introduce various basic mechanisms and their applications.
- Explain importance of degree of freedom.
- Familiarize velocity and acceleration in mechanisms.
- Describe the cams and follower motions.
- Explain the importance of gyroscopic couples.
- Introduce the equation of motion for single degree of freedom system.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand different mechanisms and their inversions.	L2
CO2	Calculate velocity and acceleration of different links in a mechanism	L4
CO3	Apply the effects of gyroscopic couple in ships, aero planes and road vehicles.	L3
CO4	Evaluate unbalance mass in rotating machines.	L5
CO5	Analyze free and forced vibrations of single degree freedom systems.	L4

UNIT – I: Simple Mechanisms

Simple Mechanisms: Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains- Limit positions – Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line mechanisms – UniversalJoint – Rocker mechanisms.

UNIT – II: Plane and motion analysis

Plane and motion analysis: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations – kinematicanalysis of simple mechanisms – slidercrank mechanism dynamics – Coincidentpoints – Corioliscomponent of acceleration.

UNIT – III: Gyroscope & Gear Profile

Gyroscope: Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two wheeler, simple problems

Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

UNIT – IV: Balancing of Rotating masses & Cams

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

Cams: Classification of cams and followers- Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – derivatives of follower motions- specified contour cams- circular and tangent cams –pressure angle and undercutting.

UNIT – V: Vibrations & Turning Moment Diagrams and Flywheels

Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.

Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.

Textbooks:

1. S.S.Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L.Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

Reference Books:

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E.Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K.Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.: Prentice Hall, 1993.

II Year B.Tech. ME – II Semester

L	T	P	C
0	0	3	1.5

(23A03402P) FLUID MECHANICS & HYDRAULIC MACHINERY LAB

CourseObjective: Toimpartpracticalexposureon the performance valuationmethodsofvariousflowmeasuringequipmentandhydraulicturbinesandpumps.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Demonstrate the devices used for measuring flow.	L3
CO2	Compute major losses in pipes.	L5
CO3	Illustrate the operating parameters of turbines.	L2
CO4	Explain the working of different types of pumps.	L2
CO5	Explain the devices used for measuring flow.	L2

List of Experiments

1. Impact ofjetson Vanes.
2. Performance Test onPelton Wheel.
3. PerformanceTestonFrancis Turbine.
4. PerformanceTestonKaplan Turbine.
5. PerformanceTestonSingle Stage Centrifugal Pump.
6. PerformanceTestonMultiStageCentrifugal Pump.
7. PerformanceTestonReciprocating Pump.
8. CalibrationofVenturimeter.
9. Calibration ofOrificemeter.
10. Determinationoffrictionfactorfor agivenpipeline.
11. Determinationoflossofheadduetosuddencontractionina pipeline.
12. Turbineflowmeter.

Virtual Lab:

1. To study different patterns of a flow through a pipe and correlate them with the Reynolds number of the flow. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/introduction.html)
2. To calculate Total Energy at different points of venture meter. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html).
3. To calculate the flow (or point) velocity at center of the given tube using different flow rates. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html)
4. To determine the hydrostatic force on a plane surface under partial submerge and full submerge condition. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/cop/introduction.html).
5. To determine the discharge coefficient of a triangular notch. (https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html)
6. To determine the coefficient of impact of jet on vanes. (https://fm-nitk.vlabs.ac.in/exp/impact-of-jet).
7. To determine friction in pipes. (https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/index.html).

II Year B.Tech. ME – II Semester

L	T	P	C
0	0	3	1.5

(23A03401P) MANUFACTURING PROCESSESLAB

CourseObjective: Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Make moulds for sand casting.	L2
CO2	Fabricate different types of components using various manufacturing techniques.	L5
CO3	Adapt unconventional manufacturing methods.	L3
CO4	Develop Different Weld joints.	L6
CO5	Explain different types of 3d Printing techniques.	L2

List of Experiments

1. Designandmakingof pattern
   i. Single piece pattern
   ii. Split pattern
2. Sandproperties testing
   i. Sieveanalysis(drysand)
   ii. Claycontenttest
   iii. Moisturecontent test
   iv. Strengthtest(Compressiontest&Shear test)
   v. Permeability test
3. Mould preparation
   i. Straight pipe
   ii. Bent pipe
   iii. Dumble
   iv. Gearblank
4. Gascuttingand welding
5. Manualmetalarcwelding
   i. Lapjoint
   ii. Buttjoint
6. InjectionMolding
7. BlowMolding
8. Simplemodelsusingsheetmetaloperations
9. Studyofdeepdrawingandextrusionoperations
10. To make weldments usingTIG/MIGwelding
11. To weld usingSpotwelding machine
12. To join using BrazingandSoldering
13. To make simple parts on a 3D printing machine
14. Demonstration of metal casting.

Virtual Lab:

1. To study and observe various stages of casting through demonstration of casting process. (https://virtual-labs.github.io/exp-sand-casting-process-dei/theory.html)
2. To weld and cut metals using an oxyacetylene welding setup. (https://virtual-labs.github.io/exp-gas-cutting-processes-iitkgp/index.html).
3. To simulate Fused deposition modelling process (FDM) (https://3dpdei.vlabs.ac.in/exp/simulation-modelling-process)
4. https://altair.com/inspire-mold/
5. https://virtual-labs.github.io/exp-simulation-cartesian-system-dei/theory.html

II Year B.Tech. ME – II Semester

L	T	P	C
0	1	2	2

(23A52403) SOFT SKILLS

Course Objectives:
- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To enhance healthy relationship and understanding within and outside an organization
- To function effectively with heterogeneous teams

Course Outcomes
- List out various elements of soft skills (L1, L2)
- Describe methods for building professional image (L1, L2)
- Apply critical thinking skills in problem solving (L3)
- Analyse the needs of an individual and team for well-being (L4)
- Assess the situation and take necessary decisions (L5)
- Create a productive workplace atmosphere using social and work-life skills ensuring personal and emotional well-being (L6)

UNIT I Soft Skills & Communication Skills

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity.

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.

UNIT II Critical Thinking

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT III Problem Solving & Decision Making

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

Activities:
Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.
Case Study & Group Discussion

UNIT IV Emotional Intelligence & Stress Management
Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:
Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.
Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT V Corporate Etiquette
Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette - Corporate grooming tips -Overcoming challenges

Activities
Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

NOTE-:
1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

Prescribed Books:
1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018

Reference Books
1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand& Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018

5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7. https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

II Year B.Tech. ME – II Semester

L	T	P	C
1	0	2	2

(23A99401) DESIGN THINKING & INNOVATION

Course Objectives:
The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:
- Define the concepts related to design thinking. (L1, L2)
- Explain the fundamentals of Design Thinking and innovation (L1, L2)
- Apply the design thinking techniques for solving problems in various sectors. (L3)
- Analyse to work in a multidisciplinary environment (L4)
- Evaluate the value of creativity (L5)
- Formulate specific problem statements of real time issues (L3, L6)

UNIT I Introduction to Design Thinking
Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II Design Thinking Process
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III Innovation
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT IV Product Design
Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs-Design thinking for Startups- Defining and testing Business Models and Business Cases-Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell,Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

Online Learning Resources:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

COMMUNITY SERVICE PROJECT

……Experiential learning through community engagement

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.

- Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
    - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
    - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
        - Agriculture
        - Health
        - Marketing and Cooperation
        - Animal Husbandry
        - Horticulture
        - Fisheries
        - Sericulture
        - Revenue and Survey
        - Natural Disaster Management
        - Irrigation
        - Law & Order
        - Excise and Prohibition
        - Mines and Geology
        - Energy
        - Internet
        - Free Electricity
        - Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students’ academic learning
- Improves students’ ability to apply what they have learned in “the real world”
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development

- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability

2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films

6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
    - i. Agriculture
    - ii. Health
    - iii. Marketing and Cooperation
    - iv. Animal Husbandry
    - v. Horticulture
    - vi. Fisheries
    - vii. Sericulture
    - viii. Revenue and Survey
    - ix. Natural Disaster Management
    - x. Irrigation
    - xi. Law & Order
    - xii. Excise and Prohibition
    - xiii. Mines and Geology
    - xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Three Weeks)

Along with the Community Awareness Programmes, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

(Established by Govt. of A.P., ACT No.30 of 2008)

ANANTHAPURAMU – 515 002 (A.P) INDIA

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B. Tech (Regular-Full time)

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

MECHANICAL ENGINEERING

COURSE STRUCTURE
AND
SYLLABUS

B. TECH-ME-III-I Sem

S.No	Course code	Title	L	T	P	Credits
1	23A03501	Machining Process	3	0	0	3
2	23A03502T	Thermal Engineering	3	0	0	3
3	23A03503	Metrology and Measurements	3	0	0	3
4	23A05503	Introduction To Quantum Technologies And Applications	3	0	0	3
5	23A03504a 23A03504b 23A03504c 23A03504d 23A03504e	**Professional Elective-I** 1. Tool Design 2. Automobile Engineering 3. Mechanical behaviour of Materials 4. Work study and Ergonomics 5. Nano Technology	3	0	0	3
6		**Open Elective-I**	3	0	0	3
7	23A03502P	Thermal Engineering Lab	0	0	3	1.5
8	23A03506	Dynamics lab	0	0	3	1.5
9	23A03507	**Skill Enhancement course** Machine Tools & Metrology lab	0	1	2	2
10	23A03508	**Engineering Science** Tinkering Lab	0	0	2	1
11	23A03509	**Evaluation of Community Service Internship** Community Service Internship/Project	-	-	-	2
		Total	18	1	10	**26**

Note:
1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1	23A01505a	Green Buildings	CIVIL
2	23A01505b	Construction Technology and Management	
3	23A02505	Electrical Safety Practices and Standards	EEE
4	23A04505	Electronic Circuits	ECE
5	23A05506a	Java Programming	CSE & Allied/IT
6	23A05506b	Fundamentals of Artificial Intelligence	
7	23A05506c	Quantum Technologies and Applications	
8	23A54501	Mathematics for Machine Learning and AI	Mathematics
9	23A56501	Materials Characterization Techniques	Physics
10	23A51501	Chemistry of Energy Systems	Chemistry
11	23A52502a	English for Competitive Examinations	Humanities
12	23A52502b	Entrepreneurship and New Venture Creation	

B. TECH-ME-III-II

S.No	Course code	Title	L	T	P	Credits
1	23A03601T	Heat Transfer	3	0	0	3
2	23A03602T	CAD/CAM	3	0	0	3
3	23A03603	Design of Machine Members	3	0	0	3
4	23A03604a 23A03604b 23A03604c 23A03604d 23A03604e	**Professional Elective-II** 1. Engineering Fracture Mechanics 2. Introduction of Turbo Machinery 3. Control Systems 4. Operations Research 5. Smart Materials	3	0	0	3
5	23A03605a 23A03605b 23A03605c 23A03605d 23A03605e	**Professional Elective-III** 1. Applications of Computational Fluid dynamics 2. Industrial Safety 3. Design of Automobile Transmission Systems 4. Mechanics & Manufacturing of Composite Materials 5. Introduction to hybrid and electric vehicles	3	0	0	3
6		**Open Elective - II**	3	0	0	3
7	23A03601P	Heat Transfer Lab	0	0	3	1.5
8	23A03602P	CAD/CAM Lab	0	0	3	1.5
9	23A03607	**Skill Enhancement course** 3 D Printing Lab	0	1	2	2
10	23A52601	**Audit Course** Technical paper writing and IPR	2	0	0	-
11	23A03608	Workshop	0	0	0	0
Total			**20**	**1**	**08**	**23**
Mandatory Industry Internship of 6-8 weeks duration during summer vacation						

Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1	23A01606a	Disaster Management	CIVIL
2	23A01606b	Sustainability In Engineering Practices	
3	23A02605	Renewable Energy Sources	EEE
4	23A04606	Digital Electronics	ECE
5	23A32502T	Operating Systems	CSE& Allied/IT
6	23A32501T	Introduction of Machine Learning	
7	23A54601a	Optimization Techniques for Engineers	Mathematics
8	23A54601b	Mathematical Foundation Of Quantum Technologies	
9	23A56601	Physics Of Electronic Materials And Devices	Physics
10	23A51601	Chemistry Of Polymers And Applications	Chemistry
11	23A52602	Academic Writing and Public Speaking	Humanities

B. TECH-ME-IV-I

S.No	Course code	Title	L	T	P	Credits
1	23A03701	AI & ML for Mechanical Engineering	3	0	0	3
2	23A52701a 23A52701b 23A52701c	**Management Course- II** 1.Business Ethics and Corporate Governance 2.E-Business 3.Management Science	2	0	0	2
3	23A03702a 23A03702b 23A03702c 23A03702d 23A03702e	**Professional Elective-IV** 1. Mechanical Vibrations 2. Finite Element Methods 3. Refrigeration & Air Conditioning 4. Mechotronics & MEMS 5. Power Plant Engineering	3	0	0	3
4	23A03703a 23A03606 23A03703b 23A03703c 23A03703d	**Professional Elective-V** 1. Non Conventional Energy Sources 2. Automation And Robotics 3. Non-Destructive Testing 4. Total Quality Management 5. Smart Manufacturing	3	0	0	3
5		**Open Elective - III**	3	0	0	3
6		**Open Elective - IV**	3	0	0	3
7	23A03706	**Skill Enhancement Course** Intraduction to Drone Technology	0	1	2	2
8	23A52702	**Audit Course** Gender Sensitization	2	0	0	-
9	23A03707	**Internship** Evaluation of Industry Internship	-	-	-	2
Total			**18**	**1**	**04**	**21**

Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	23A01704a	Building Materials and Services	CIVIL
2	23A01704b	Environmental Impact Assessment	
3	23A02704	Smart Grid Technologies	EEE
4	23A04503T	Microprocessors and Microcontrollers	ECE
5	23A05402T	Data Base Management Systems	CSE & Allied/IT
6	23A38502	Cyber Security	
7	23A54701	Wavelet transforms and its Applications	Mathematics
8	23A56701a	Smart Materials And Devices	Physics
9	23A56701b	Introduction to Quantum Mechanics	
10	23A51701	Green Chemistry And Catalysis For Sustainable Environment	Chemistry
11	23A52703	Employability Skills	Humanities

Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	23A01705a	Geo-Spatial Technologies	CIVIL
2	23A01705b	Solid Waste Management	
3	23A02705	Electric Vehicles	EEE
4	23A04704	Transducers and Sensors	ECE
5	23A05502T	Introduction to Computer Networks	CSE & Allied/IT
6	23A35501T	Internet of Things	
7	23A32603	Introduction to Quantum Computing	
8	23A54702	Financial Mathematics	Mathematics
9	23A56702	Sensors And Actuators For Engineering Applications	Physics
10	23A51702	Chemistry Of Nanomaterials and Applications	Chemistry
11	23A52704	Literary Vibes	Humanities

IV B.Tech II Semester (ME)

S.No.	Course code	Title	Category	L	T	P	Credits
1	23A03801	Internship		-	-	-	4
2	23A03802	Project		-	-	-	8
		Total					**12**

COURSES OFFERED FOR HONOURS DEGREE IN MECHANICAL ENGINEERING

S. No.	Course Code	Title	L	T	P	Credits
1	23A03H01	Automotive Thermal Systems	3	0	0	3
2	23A03H02	Simulation and Modelling of Manufacturing Systems	3	0	0	3
3	23A03H03	Supply Chain Management	3	0	0	3
4	23A03H04	Advanced Mechanism Design	3	0	0	3
5	23A03H05	Bio Mechanics	3	0	0	3
6	23A03H06	Applied Project Work	0	0	6	3
		Total	15	0	6	18

LIST OF MINORS OFFERED TO MECHANICAL ENGINEERING

S.No.	Minor Title	Department offering the Minor
1	Building Planning & Construction Technology	Civil
2	Micro Grid Technology	EEE
3	Energy Systems	
4	Embedded Systems and IoT	ECE & VLSI
5	Electronic Systems	
6	Computer Science and Engineering	CSE & Allied
7	Cyber Security	
8	Internet of Things	
9	Data Science	
10	Artificial Intelligence & Machine Learning	
11	Data Analytics	
12	Data Science and Analytics	
13	Programming & Computational Intelligence	
14	AI Applications & Emerging Technologies	
15	Quantum Computing	
16	Quantum Technologies	

B. TECH-ME-III-I Sem

		L	T	P	C
23A03501	**MACHINING PROCESSES**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Gain knowledge on working principle of different metal cutting processes and familiarize with cutting forces, machining calculations and cutting fluids.
2	Make the student learn about principles of lathe and Drilling machines.
3	Make the student learn about principles of Grinding and Milling machines.
4	To acquire knowledge in the elementary mechanism and machinability of materials with different Mechanical and Electrical energy based Machining Processes.
5	To make student familiar with various advanced machining operations.

Course Outcomes: On successful completion of the course, the student will be able to,		
CO1	Operation of various machines like lathe, drilling, grinding, slotting, shaping, milling etc	**L1, L2**
CO2	Practical exposure on flat surface machining, milling and grinding operations.	**L2**
CO3	Illustrate advanced machining processes, cutting tools and cutting fluids for a specific material and part features.	**L1, L2**
CO4	Differentiate Electrical Energy Based machining processes, mechanism of metal removal, machine tool selection.	**L3**
CO5	Interpret Electro Chemical machining process, economic aspects of ECM	**L2, L4**

UNIT I

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant’s Force diagram, cutting forces – cutting speeds, feed, depth of cut, heat generation, tool life, coolants, machinability –economics of machining. cutting Tool materials and cutting fluids –types and characteristics.

UNIT II

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread cutting operations and attachments for Lathes.

Drilling, Boring Machines, Shaping, Slotting and planning machines - Principles of working, specifications, types, Tools and tool holding devices – operations performed, machining time calculation.

UNIT III

Milling machine – Principles of working – specifications – classifications of milling machines – methods of indexing, milling cutters - machining operation, Accessories to milling machines.

Grinding machine –Theory of grinding – classification– cylindrical and surface grinding machine – Tool and cutter grinding machine – Grinding wheel specification - types of abrasives – bonds, Truing and Dressing of wheels. Lapping, Honing and Broaching machines – comparison of grinding, lapping and honing. Principles of design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping –types.

UNIT IV

Mechanical Energy Based Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultra Sonic Machining – Working Principle, Description of Equipment, Process Parameters, Metal Removal Rate, Applications, Advantages and Limitations.

Electrical Energy Based Processes: Electric Discharge Machining – Wire cut EDM - Working Principles, Process Parameters, Applications Advantages and Limitations.

UNIT V

Chemical and Electro Chemical Energy Based Processes: Chemical Machining and Electro Chemical Machining – Working Principle, Etchants, Maskants, Techniques of Applying - Process Parameters, Electro Chemical Grinding, Electro Chemical Honing, Applications, Advantages and Limitations.

Thermal Energy Based Processes: Laser Beam Machining and Drilling, Plasma Arc Machining, Electron Beam Machining – Working Principle, Process Parameters, Applications, Advantages and Limitations.

Text Books:

1. Manufacturing Technology-Kalpakzian- Pearson Seventh edition. (2018)
2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition.
3. Jain V.K., Advanced Machining Processes, 1st Edition, Allied Publishers Pvt. Ltd., New Delhi, 2007.

Reference Books:

1. Pandey P.C and Shan H.S., Modern Machining Processes, 1/e, McGraw Hill, New Delhi, 2007.
2. Benedict G.F., Non-traditional Manufacturing Processes, 1/e, CRC Press, 1987.
3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st edition, 2001
4. Manufacturing Technology Vol II by P.N. Rao, Tata McGraw Hill, 4th edition, 2013
5. Machine Technology Machine tools and operations by Halmi A Yousuf & Harson, CRC Press Taylor and Francies .
6. Workshop Technology – Vol II, B.S.Raghu Vamshi, Dhanpat Rai & Co, 10th edition, 2013

Online Learning Resources:

- https://nptel.ac.in/courses/112/107/112107078/
- https://youtu.be/t3y_Ys3LgGM
- https://www.youtube.com/watch?v=E4VZ_rFqpG4&t=1s
- https://youtu.be/-tcaR7oSx_w
- https://youtu.be/Uybg6VDLoRQ
- https://youtu.be/Uybg6VDLoRQ
- https://youtu.be/aWQsEX1TrSI

B. TECH-ME-III-I Sem

23A03502T	THERMAL ENGINEERING	L	T	P	C
		3	0	0	3

	Course objectives: The objectives of the course are to
1	Impart the knowledge on I C Engine
2	Demonstrate fuel systems, Cooling modes and types of ignitions systems.
3	Explain the fuel and combustion systems variables and its effects.
4	Study of engine Performance and its characteristics
5	Instruct the awareness on Air compressors and exercise the problems on compressors

Course Outcomes: On successful completion of the course, the student will be able to,		
CO1	understand working of different I.C Engines and recognize basic elements and subsystems of an I.C. Engine	**L1, L2, L3**
CO2	Investigate S.I Engine fuel air requirements, evaluate fuel supply systems in an S.I Engine, create necessary cooling modes and differentiate different ignition systems.	**L2, L3, L5, L6**
CO3	Analyze the Flame Speed and Effect of Engine Variables and evaluate the abnormal combustion effects and its causes.	**L3, L5, L6**
CO4	Applying of different input parameters to analyze and create the best performance in S.I and C.I Engines and resolve the influence of normal and abnormal combustions.	**L3, L4, L5. L6**
CO5	Familiarized the working principle of various types of air compressors and solve problems related to reciprocating air compressor.	**L1, L2, L3**

UNIT-I

I.C. ENGINES : Definition of Engine and Heat Engine, I.C Engine Classification – Parts of I.C. Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C. Engines SI & CI Engines, Valve and Port Timing Diagrams.

UNIT-II

Fuel System: S.I. Engine: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Gasoline Injection Systems.

Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System, Lubrication Systems-Flash, Pressurized and Mist Lubrication.

Ignition System: Function of an Ignition System, Battery coil Ignition System, Magneto Coil Ignition System, Electronic Ignition System using Contact Breaker, Electronic Ignition using Contact Triggers – Spark Advance and Retard Mechanism.

UNIT-III

Fuels and Combustion:

S I engine : Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

Engines: Stages Of Combustion – Delay Period And Its Importance – Effect Of Engine

Variables – Diesel Knock– Combustion Chambers (DI And IDI), Fuel Requirements and Fuel Rating.

UNIT – IV

Testing and Performance : Parameters of Performance - Measurement of Cylinder Pressure, Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Determination of Frictional Losses And Indicated Power – Performance Test – Heat Balance Sheet and Chart.

UNIT-V

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors.

TEXT BOOKS:

1. I.C. Engines / V. Ganesan- TMH fourth edition (2017)
2. Thermal Engineering / Rajput / Lakshmi Publications 11th edition (2020)
3. Internal Combustion Engine Fundamentals John B. Heywood TMH (2017)

REFERENCES:

1. IC Engines – Mathur& Sharma – DhanpathRai& Sons (2017)
2. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI 2nd edition (2015)
3. Thermal Engineering, Rudramoorthy – TMH First edition (2017)
4. Thermodynamics & Heat Engines, B. Yadav, Central Book Depot., Allahabad (2002)
5. Thermal Engineering / Rajput / Lakshmi Publications 11th edition (2020)

Online Learning Resources:

https://nptel.ac.in/courses/112103316

https://youtube.com/playlist?list=PLwdnzlV3ogoWV-_n1YItO933MxgPXfEiM&si=QcuZlil5MRldeTiD

https://youtu.be/FDmYCI_xYlA?si=vS1kdhqc5WCRnl21

https://youtube.com/playlist?list=PLfq4fiRrJSn5leKEZoUF-2vBkMG37iGs8&si=nZVdvgmACy-lVvSC

B. TECH-ME-III-I Sem

		L	T	P	C
23A03503	**METROLOGY MEASUREMENTS**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Explain the system of limits, fits &tolerances and design of gauges.
2	Identify the use of flatness and surface gauges
3	Know the measurement of screw thread, Gear profiles.
4	Describe the Measurement of Displacement and Strain.
5	Illustrate the measuring process of Pressure, Force and Torque.

Course Outcomes: On successful completion of the course, the student will be able to,		
CO1	Demonstrate the concept of different types of dimensional tolerances and chose the desire limits and fit component to solve the required fit.	L2, L3,L6
CO2	Explain the basic standards of measurements and also apply the desired flatness and surface gauges to analyze the dimensions.	L2, L3,L4
CO3	Evaluate engineering parts with various precision instruments and choose the required surface roughness instrument to compare the parts.	L4,L5,L6
CO4	List out various measuring techniques for Displacement and Strain. Define the various instruments for measuring the displacement and calibrate the strain.	L2, L1,L5
CO5	Estimate the Instruments accuracy and Perform calibration of Force, Torque and pressure measuring instruments	L6, L5,L1

UNIT I

Concept of measurement

Concept of Measurement: Concept of feedback Control systems -generalized measurement system, units and standards, measuring instruments, sensitivity, readability, range of accuracy, precision, static and dynamic response, repeatability, systematic and random errors, correction, calibration, terminology and limits fits and tolerances, hole basis and shaft basis system, interchangeability.

Limit Gauges And Gauge Design: Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle. Design of Go and No Go gauges.

Linear and Angular Measurement: Linear measuring instruments: Vernier instruments, micrometers, slip gauges, tool makers microscope. Comparators: Mechanical, pneumatic and electrical. **Angular measurements:** Sine bar, bevel protractor and angle dekkor, rollers and spheres used to determine the tapers.

UNIT – II

Flatness and Surface Roughness measurement

Flatness Measurement: Measurement of flatness – straight edges – surface plates, optical flat and autocollimators, interferometers and their applications.

Surface Roughness Measurement: Terminology systems, differences between surface roughness and surface waviness- Numerical assessment of surface finish - CLA, R.M.S Value-R_a, R_z values, Methods of measurement of surface finish-profilograph, talysurf, BIS symbols for indication of surface roughness.

UNIT – III

Screw Thread and Gear Measurement

Screw thread measurements: Elements of threads, errors in screw threads, various methods for measuring external and internal screw threads, screw thread gauges.

Gear Measurement: Gear tooth terminology, measurement of gear elements-run out, lead, pitch backlash, profile, pressure angle, tooth thickness, diameter of gear, constant chord and base tangent method.

Coordinate Measuring Machine (CMM)- Construction and features.

UNIT – IV

Measurement of Displacement and Strain

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo-electric, inductive, capacitance, resistance, ionization and photoelectric transducers, calibration procedures.

Measurements of Strain: Various types of electrical strain gauges, gauge factor, method of usage of resistance strain gauge for bending, compressive and tensile strains, usage for measuring torque, strain gauge rosettes.

UNIT – V

Measurement of Force, Torque and Pressure

Measurement of Force: Direct method - analytical balance, platform balance; elastic members – load cells, cantilever beams and proving rings.

Measurement of Torque: Torsion bar dynamometer, servo controlled dynamometer and absorption dynamometer.

Measurement of Pressure: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, High and low pressure measurement, Elastic transducers.

Textbooks:

1. Beckwith, Marangoni, Linehard, Mechanical Measurements, 6/e, PHI, 2013.
2. R.K. Jain, Engineering Metrology, 20/e, Khanna Publishers, 2013.

Reference Books:

1. Mahajan, Engineering Metrology, 2/e, Dhanpat Rai, 2013.
2. S.Bhaskar, Basic Principles - Measurments and Control Systems, Anuradha Publications, 2014.
3. Anand K Bewoor& Vinay A Kulkarni, Metrology & Measurement, 15/e, McGrawHill, 2015.
4. D.S. Kumar, Mechanical Measurements & Control, Metropolitan Publishers, 5/e, 2015.

Online Learning Resources:

- https://nitsri.ac.in/Department/Mechanical%20Engineering/MEC_405_Book_2,_for_Unit_2 B.pdf
- https://www.digimat.in/nptel/courses/video/112104250/L47.html
- https:/
- www.digimat.in/nptel/courses/video/112106138/L01.ht ml

https://www.digimat.in/nptel/courses/video/112106179/L01

- html https://www.youtube.com/watch?v=tczyyM4Dykc
- https://www.youtube.com/watch?v=_UsAiZ mRC1M
- https://www.youtube.com/watch?v=oCkax I19X8

23A05503	INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS (Qualitative Treatment)	L	T	P	C
		3	0	0	3

Course Objectives (COBJ):

- Introduce fundamental quantum concepts like superposition and entanglement.
- Understand theoretical structure of qubits and quantum information.
- Explore conceptual challenges in building quantum computers.
- Explain principles of quantum communication and computing.
- Examine real-world applications and the future of quantum technologies.

Course Outcomes (CO):

- Explain core quantum principles in a non-mathematical manner.
- Compare classical and quantum information systems.
- Identify theoretical issues in building quantum computers.
- Discuss quantum communication and computing concepts.
- Recognize applications, industry trends, and career paths in quantum technology.

Unit 1: Introduction to Quantum Theory and Technologies

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison,Quantum states and measurement: nature of observation,Overview of quantum systems: electrons, photons, atoms,The concept of quantization: discrete energy levels,Why quantum? Strategic, scientific, and technological significance,A snapshot of quantum technologies: Computing, Communication, and Sensing,National and global quantum missions: India’s Quantum Mission, EU, USA, China

Unit 2: Theoretical Structure of Quantum Information Systems

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract,The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences,Philosophical implications: randomness, determinism, and observer role

Unit 3: Building a Quantum Computer – Theoretical Challenges and Requirements

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers:

Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what’s working and what remains elusive,The role of quantum software in managing theoretical complexities

Unit 4: Quantum Communication and Computing – Theoretical Perspective

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication,The Idea of the Quantum Internet – Secure Global Networking,Introduction to Quantum Computing,Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: Decoherence and Error Correction,Real-World Importance and Future Potential

Unit 5: Applications, Use Cases, and the Quantum Future

Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum,Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization,Emerging careers in quantum: roles, skillsets, and preparation pathways,Educational and research landscape – India's opportunity in the global quantum race

Textbooks**:**

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
3. Chris Bernhardt, *Quantum Computing for Everyone*, MIT Press, 2019.

Reference Books**:**

1. David McMahon, *Quantum Computing Explained*, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, *An Introduction to Quantum Computing*, Oxford University Press, 2007.
3. Scott Aaronson, *Quantum Computing Since Democritus*, Cambridge University Press, 2013.
4. **Alastair I.M. Rae**, *Quantum Physics: A Beginner's Guide*, Oneworld Publications, Revised Edition, 2005.
5. **Eleanor G. Rieffel, Wolfgang H. Polak**, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.
6. **Leonard Susskind, Art Friedman**, *Quantum Mechanics: The Theoretical Minimum*, Basic Books, 2014.
7. **Bruce Rosenblum, Fred Kuttner**, *Quantum Enigma: Physics Encounters Consciousness*, Oxford University Press, 2nd Edition, 2011.
8. **GiulianoBenenti, GiulioCasati, GiulianoStrini**, *Principles of Quantum Computation and Information, Volume I: Basic Concepts*, World Scientific Publishing, 2004.
9. **K.B. Whaley et al.**, *Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document*, Quantum Flagship, European Commission, 2020.
10. **Department of Science & Technology (DST), Government of India**, *National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers*, MeitY/DST Publications, 2020 onward.

Online Learning Resources**:**

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers
- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

B. TECH-ME-III-I Sem

		L	T	P	C
23A03504a	**TOOL DESIGN** **(Professional Elective-IV)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Understand the fundamentals of tool engineering and the role of tool design in manufacturing.
2	Analyze the principles of metal cutting and apply them to cutting tool design.
3	Design various jigs and fixtures using proper locating and clamping principles.
4	Evaluate and design different types of press tool dies for sheet metal operations.
5	Develop tooling and fixture strategies suitable for CNC machining systems.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Understand tool design fundamentals, select appropriate materials, and design effective tools to develop durable, precise tools for various manufacturing applications.	L2, L3,L6
2	Define Oblique and orthogonal cutting **,** Apply the mechanics of metal cutting to design basic cutting tools like single-point, milling, and broaching tools.	L1,L3,L6
3	Demonstrate basic principles of drill jigs and various fixtures and design the jigs and fixtures by applying principles of location and clamping.	L2,L3,L6
4	Calculate clearance, cutting forces, and develop designs for press tool dies (blanking, piercing, bending, and drawing).	L2,L4,L6
5	Evaluate and Develop tool holding, fixture systems, and automation features like ATC for CNC machine tools.	L1,L5,L6

UNIT I

INTRODUCTION TO TOOL DESIGN

Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non ferrous Tooling Materials- Carbides, Ceramics and Diamond **-**Non metallic tool materials-Designing with relation to heat treatment.

UNIT II

DESIGN OF CUTTING TOOLS

Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle - Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters.

UNIT III

DESIGN OF JIGS AND FIXTURES

Introduction – Fixed Gages – Gage Tolerances –selection of material for Gauges – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – General considerations in the design of drill jigs – Drill bushings – Methods of construction –Types of Fixtures – Vice Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures.

UNIT IV

DESIGN OF PRESS TOOL DIES

Types of Dies –Method of Die operation–Clearance and cutting force calculations- Blanking and Piercing die design – Pilots – Strippers and pressure pads- Presswork materials – Centre of pressure -Strip layout – Short-run tooling for Piercing – Bending dies – Drawing dies-Design and drafting.

UNIT V

TOOL DESIGN FOR CNC MACHINE TOOLS

Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools-Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine.

Textbooks:

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2000.
2. E.G.Hoffman,” Jig and Fixture Design”, Thomson Asia Pvt Ltd, Singapore, 2004.

Reference Books:

1. P.C.Sharma, A Text book of Production Engineering, S.Chand Publications, 1999.
2. Prakash Hiralal Joshi, “Tooling data”, Wheeler Publishing, 2000
3. Venkataraman K., “Design of Jigs, Fixtures and Presstools”, TMH, 2005.
4. Haslehurst M., “Manufacturing Technology”, The ELBS, 1978.

Online Learning Resources:

- https://www.iare.ac.in/sites/default/files/lecture_notes/TOOL%20DESIGN_Lecture_Notes.pdf
- https://www.cet.edu.in/noticefiles/261_MMP%20Lecture%20Notes-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture-notes.php?url=production-engineering
- https://nptel.ac.in/courses/112/105/112105233/
- https://www.youtube.com/watch?v=7MkX-sW97rI
- https://nptel.ac.in/courses/112/105/112105126/#

B. TECH-ME-III-I Sem

		L	T	P	C
23A03504b	**AUTOMOBILE ENGINEERING (Professional Elective-I)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

	Course objectives: The objectives of the course are to
1	Impart the knowledge on I C Engine, Automobile chasis and Body
2	Demonstrate fuel systems and types of ignitions systems.
3	Explain the Principles of Steering system and Suspension system.
4	Gain knowledge wheels, Tyres and Braking system.
5	Make the students with the awareness on Automobile electrical system.

COURSE OUTCOMES On successful completion of this course the student will be able to		
CO1	*Find the different parts and develop the automobile systems to analyze engine components*	L1, L3,L4
CO2	*Identify the working of various parts in ignition system to apply the different vehicles and design the ignition and fuel injection systems.*	L3, L4,L6
CO3	*Demonstrate how the steering and the suspension systems works, types of steering and suspension systems and its applications.*	L2,L3,L5
CO4	Recognize the different types of wheels and breaking systems. Choose the suitable tyres and brakes for different applications.	L2, L3,L4
CO5	Utilize different electrical systems in automobiles. Apply advanced electrical circuits.create advanced Global Positioning System (GPS), Hybrid vehicle, Fuel Cell.	L1, L3,L6

UNIT I

Introduction to vehicle structure and engine components

Vehicle construction - Chassis and body - Specifications - Engine - Types - Construction - Location of engine - Cylinder arrangement - Construction details - Cylinder block - Cylinder head - Cylinder liners - Piston – piston rings - Piston pin - Connecting rod - Crankshaft - Valves. Lubrication system - Types - Oil pumps - Filters. Crankcase ventilation.

UNIT II

Ignition and fuel supply systems

Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit Injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI.

UNIT – III

Steering and suspension system

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering - front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

UNIT – IV

Wheels, Tyres and Braking System

Wheels and Tyres - Construction - Type and specification - Tyre wear and causes - Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assist – Retarders – Anti-lock Braking System(ABS).

UNIT – V

Automobile electrical systems and advances in automobile engineering

Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP), Traction Control System (TCS) - Global Positioning System (GPS), Hybrid vehicle, Fuel Cell.

Textbooks:

1. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications, 13/e, 2020.
2. William.H.Crouse, Automotive Mechanics, 10/e , McGraw-Hill, 2006.
3. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, 2009.

Reference Books:

1. Bosch, Automotive Hand Book, 6/e, SAE Publications, 2007.
2. K. Newton and W. Steeds, The motor vehicle, 13/e, Butterworth-Heinemann Publishing Ltd, 1989.
3. Joseph Heitner, Automotive Mechanics Principles and Practices, 2/e, CBS publishing 2004.
4. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International, 2004.

Online Learning Resources:

- https://nptel.ac.in/courses/107106088
- https://nptel.ac.in/courses/107106080
- https://hindustanuniv.ac.in/assets/pdf/ug/CBCS/cbcs-automobile-2018.pdf
- https://ed.iitm.ac.in/~shankarram/Course_Files/ED5160/ED5160.htm
- https://dbatu.ac.in/wp-content/uploads/2020/07/B-Tech-Automobile_Final-Yr_22.06.2020-pdf
- https://www.youtube.com/channel/UCGLlbmSTaLNUPhDwsMe-SgQ

B. TECH-ME-III-I Sem

23A03504c	MECHANICAL BEHAVIOUR OF MATERIALS (Professional Elective-I)	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	Explain the structure of material over the effects of mechanical properties.
2	Familiarize the defects inside the structure and their effects on the mechanical properties.
3	Train the methods for characterization of the mechanical behavior of materials.
4	Impart knowledge about strengthening mechanisms of materials.
5	Teach mechanisms of failures of materials (fracture, fatigue and creep) and their relationship with the different types of stress.

COURSE OUTCOMES On successful completion of this course the student will be able		
CO1	Dictate the elastic behaviour of engineering materials, recall Hooke's law and apply the dislocation theory, forces on and between dislocations.	**L1, L2,L3**
CO2	Apply dispersion strengthening and fibre strengthening mechanisms, differentiate strain aging and dynamic strain aging and create grain size strengthening and solid solution strengthening	**L3, L4,L6**
CO3	List various modes of fracture and clarify the basic mechanism of ductile and brittle fracture, Identify importance of Griffith's theory. Calculate factors effecting on DBTT.	**L1,L2,L3, L6**
CO4	Explain fatigue behaviour and testing. Discuss the factors affecting fatigue. Apply fracture mechanics in design.	**L2, L3,L6**
CO5	Identify and describe various structural changes during creep. Evaluate and predict the metallurgical factors affecting creep and creep different testing.	**L2, L4,L5, L6**

UNIT – I

Elastic and plastic behavior: Elastic behavior of materials – Hooke's law, plastic behavior: dislocation theory – Burger's vectors and dislocation loops, dislocations in FCC, HCP and BCC lattice, stress fields and energies of dislocations, forces on and between dislocations, slip and twinning.

UNIT – II

Strengthening mechanisms: Cold Working, Grain Size Strengthening, Solid Solution Strengthening, Martensitic Strengthening, Precipitation Strengthening, Dispersion Strengthening, Fibre Strengthening, Examples. Yield Point Phenomenon, Strain aging and Dynamic strain aging.

UNIT – III

Fracture and fracture mechanics: Types of Fracture, Basic Mechanism of Ductile and Brittle Fracture, Griffith's Theory of Brittle Fracture, Ductile to Brittle Transition Temperature (DBTT), Factors Affecting DBTT, Determination of DBTT. Fracture Mechanics-Introduction, Modes of Fracture, Stress Intensity Factor, Strain Energy Release Rate, Fracture Toughness and Determination of K_{IC}.

UNIT - IV

Fatigue behaviour and testing: Stress Cycles, S-N Curves, Effect of Mean Stress, Factors Affecting Fatigue, Structural Changes Accompanying Fatigue, Cumulative Damage, HCF / LCF, Thermo-mechanical Fatigue, Application of Fracture Mechanics to Fatigue Crack Propagation-Paris law- Fatigue Testing Machines.

UNIT - V

Creep behavior and testing: Creep Curve, Stages in Creep Curve and Explanation, Structural Changes during Creep, Creep Mechanisms, Metallurgical Factors Affecting Creep, High Temperature Alloys, Stress Rupture Testing, Creep Testing Machines.

Text books:

1. Dieter, G.E., "Mechanical Metallurgy", McGraw-Hill, SI Edition, 1995.
2. Davis. H. E., Troxell G.E., Hauck.G. E. W., "The Testing Of Engineering Materials", McGraw-Hill, 1982.

References:

1. Wulff, The Structure and Properties of Materials, Vol. III "Mechanical Behavior of Materials", John Wiley and Sons, 1983.
2. Honey Combe R. W. K., "Plastic Deformation of Materials", Edward Arnold Publishers, 1984.
3. Suryanarayana, A. V. K., "Testing of Metallic Materials", Prentice Hall India, 1979.

Online Learning Resources:

https://nptel.ac.in/courses/113104105

https://nptel.ac.in/courses/113104104

https://youtube.com/playlist?list=PLyqSpQzTE6M9QPU_tubmtQ97e7zRpaMlD&si=H5qNNyv3nYL8jztY

https://youtube.com/playlist?list=PLxQw8LdroTlPNimLKW-MWldJQHVLBESGs&si=ULCr6KGQwMPXhNC2

https://youtube.com/playlist?list=PL-g1KbXtGBBvF3G4lQuY0zSGBFHh4-5kF&si=47R1eQ_zAWcO-9A_

B. TECH-ME-III-I Sem

		L	T	P	C
23A03504d	**WORK STUDY AND ERGONOMICS (Professional Elective-I).**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are	
1	To develop concepts related to principles of productivity & work study as a tool for increasing the efficiency and effectiveness in organizational systems.
2	To study the existing method, compare and propose a new method.
3	To provide the usage of the various tools and techniques used in work measurement.
4	To develop basic ideas of ergonomics and its design.
5	To develop concepts related Man-Machine Interfaces and Design of Displays and controls.

COURSE OUTCOMES: Upon completion of this course, students should be able to:		
1	Recollect the basic concepts of productivity, work content and work study and define the objective and scope of Work Study.	L1, L2
2	Define the various charts and to construct the charts on the basis of present method and develop a new / proposed method and identify the unnecessary movements.	L1, L3 L4
3	Explain the basic work measurement techniques and to gain knowledge of measurement of work, rating and imbibe the concept of allowance in estimating Standard Time	L1, L2
4	Determine the basic concepts of Ergonomics and demonstrate a sound knowledge of Ergonomics in engineering applications.	L2, L3
5	Demonstrate a sound knowledge of Man-Machine Interfaces and design of displays and controls in engineering systems	L3, L4

UNIT – I

Productivity and Work Study: Definition of productivity, task of management, productivity of materials, land, building, machine and power, factors affecting the productivity, work content, basic work content, excess work content, how manufacturing job is made up, work content due to excess product and process, ineffective time due to short comings on part of the management. Definition, Objective and scope of Work Study: Work study and management, work study and work.

UNIT – II

Method Study: Definition, objective and scope of method study, activity recording and tools, Recording tools: Out Line Process Chart, Flow Process Chart, Flow diagram, String Diagram, Travel Chart, Multiple Activity Chart, Two- Handed process chart. Principles of Motion Economy: Introduction, Classification of movements. Two- hand process chart, Micromotion study, Therbligs, SIMO Chart. Special Charts: Cyclegraph and Chronocycle graph - development, definition and installation of the improved method. Work Measurement: Definition, objectives, work measurement techniques.

Work sampling – Need, confidence levels, and sample size determination, conducting study with problems

UNIT – III

Time study - Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating: Systems of rating, standard rating, standard performance, scales of rating. Allowances: Standard time determination, predetermined motion time study (PMTS), factors affecting rate of working, problems on allowances.

UNIT – IV

Introduction to Ergonomics: Human factors and ergonomics, psychology, engineering, bio mechanics, industrial design, graphics design, statistics, operation research and anthropometry Morphology of design and its relationship with cognitive abilities of human being. Physical Ergonomics : human anatomy, and some of the anthropometric, physiological and bio mechanical characteristics as they relate to physical activity. Cognitive: mental processes, such as perception, memory, reasoning, and motor response, mental workload, and decision-making. Organizational ergonomics: optimization of socio-technical systems, including their organizational structures, policies, processes. Communication, work design, design of working times, teamwork, cooperative work, and new work programs. Environmental ergonomics: human interaction with the environment- characterized by climate, temperature, pressure, vibration, light.

UNIT – V

Man-Machine Interaction; Man-Machine interaction cycle, Man-machine interfaces, Displays factors that control choice of display, visual displays- qualitative displays; moving pointer displays, moving scale displays, digital displays Indicators, auditory displays, tactile displays. Factors affecting effectiveness of displays. Quantitative displays, check- reading displays, representational displays. Types of controls and their integration with displays. Design guidelines for displays and controls: viewing distance, Illumination, angle of view, reach etc., general design checklist for displays and controls. Standards for ergonomics in engineering and design, displays and controls.

TEXT BOOKS

1. Introduction to Work Study – ILO, 4th edition 1992

2. Mark. S. Sanders and Ernest. J McCornick. “Human Factor in Engineering and Design”, McGraw-Hill Book Co., Inc., New York, 1993

REFERENCE BOOKS

1. S. Dalela and Sourabh, "Work Study and Ergonomics". Standard publishers 2013

2. Wesley Woodson, Peggy Tillman and Barry Tillman, "Human Factors Design Handbook", McGraw-Hill; 2ndedition, 1992

3. Ralph M. Barnes, "Motion and Time Study", Wiley International, 7th Edition.

4. Mark S. Sanders and Ernest J. McCormick , "Human Factors in Engineering Design" 4th edition, 2013.

5. B. Niebel and Freivalds, Niebel's Methods Standards and Work Design, McGraw-Hill, 12th Edition, 2009,

Online Learning Resources:

https://youtu.be/b05FPBjFH6A?si=dWB1YOLOmSMRBSX7

https://youtube.com/playlist?list=PLLy_2iUCG87BbIF6sF5sy_ZZLFoUcnncb&si=n1NAnFTtiocc9vtK

https://youtube.com/playlist?list=PLuF8VVHesRxXBZzQpQSzvJI7eM_SduxwR&si=j2vyTNYybgvXrDiy

B. TECH-ME-III-I Sem

		L	T	P	C
23A03504e	**NANO TECHNOLOGY** **(Professional Elective-I)**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES

Course objectives: The objectives of the course are to	
1	Understand the fundamentals of nano science and nanotechnology, including the history, classification and analyze the structural aspects of nanomaterials.
2	Knowledge of the synthesis and fabrication techniques used in nano science, and methods for realizing semiconductor nanostructures.
3	Advanced characterization techniques used for analysing the structural, morphological, and electronic properties of nanomaterials.
4	Explore carbon nanomaterials properties and wide-ranging applications.
5	Familiarize with the diverse applications of nanotechnology, with emphasis on nanostructured thin films and quantum dots.

COURSE OUTCOMES On successful completion of this course the student will be able to		
CO1	Define and classify nanomaterials. Explain the historical development and scope of Nano science, and nanotechnology. Analyze the band structure and electronic behavior of nanomaterials.	L1, L2,L4
CO2	Explain the synthesis processes for bulk polycrystalline and single crystal materials. Differentiate between bottom-up and top-down fabrication approaches. Identify and select the requirements for semiconductor nanostructure fabrication and techniques	L2,L3,L5
CO3	Understand and explain the principles and applications of X-ray diffraction (XRD). Analyze optical properties of nanomaterials. Evaluate appropriate characterization technique.	L2,L3, L4,L5
CO4	Discuss and Characterize various carbon nanomaterials and its applications to analyze the types, synthesis methods, and Evaluate the impact of carbon nanomaterials in emerging technologies.	L2, L3, L4, L5
CO5	Identify and describe major applications, evaluate the impact in energy production, conversion, and environmental sustainability and analyze their applications and eexplore interdisciplinary applications of nano materials**.**	L1, L2,L3, L4

UNIT-I

INTRODUCTION: History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.

PROPERTIES OF MATERIALS:

Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

UNIT-II

SYNTHESIS AND FABRICATION: Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures.

UNIT-III

CHARECTERIZATION TECHNIQUES: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

UNIT-IV

CARBON NANO TECHNOLOGY:

Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalling diamond films, grapheme, applications of carbon nano tubes.

UNIT-V

APPLICATIONS OF NANO TECHNOLOGY:

Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin fins, applications of quantum dots.

TEXT BOOK:

Nano science and nano technology / M.S Ramachandra Rao, Shubra Singh/Wiley publishers.

Introduction to Nanotechnology by Risal Singh, Shipra Mital Gupta, Oxford Higher Education, First Publication 2016.

REFERENCE BOOKS:

Introduction to Nano Technology /Charles P. Poole, Jr., Frank J.Owens/Wiley publishers.

Nanotechnology /Jermy J Ramsden/Elsevier publishers (2015)

Nano Materials/A.K.Bandyopadhyay/ New Age

Nano The Essentials, T.Pradeep, McGrawHill, 2014

Nanotechnology the Science of Small / M.A Shah, K.A Shah/Wiley Publishers.

Online Learning Resources:

https://youtube.com/playlist?list=PLyqSpQzTE6M8682dGkNTN8936vSY4CbqZ&si=8S682KjXK7_xITpT

https://youtu.be/OLa8DQkKlyU?si=I6R1Of59MArQyPUb

https://youtu.be/u1ojNgPCHGs?si=mlIgQm4OdwZnHUo3

B. TECH-ME-III-I Sem

		L	T	P	C
23A03502P	**THERMAL ENGINEERING LAB**	**0**	**0**	**3**	**1.5**

Course objectives: The objectives of the course are to	
1	To impart knowledge on working principles of various thermal equipments like compressors, IC Engines, Boilers etc.,
2	To study the working principle of IC engines, performance and characteristics in terms of heat balancing, economical speed variations, air fuel ratio etc.,

List of Experiments:

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines, economical speed test.
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.
12. Exhaust Emission test on IC Engines.

Course Outcomes: On successful completion of the course, the student will be able to,	
CO1	Performance Test on 4-Stroke Diesel and 2-Stroke Petrol engine.
CO2	Able to evaluate the Engine friction of 4-Stroke Multi cylinder Engine and Air/Fuel ratio and Volumetric efficiency of I.C.Engines.
CO3	To calculate the heat balance of the IC Engines.
CO4	To calculate the efficiencies and performance characteristics of the engines.
CO5	Study the boilers and identify parts of the engine parts.

Online Learning Resources:

- https://www.youtube.com/watch?v=i4SF47hjnjQ&list=PL0AQx5JlTK3WUCXXkA9Hev3FFLz4sESSg
- https://www.youtube.com/watch?v=B-rFIdOi-No&list=PLkUEX3IbW7lfdC2ieft_9FH5zAAvUfZAn

B. TECH-ME-III-I Sem

		L	T	P	C
23A03506	**DYNAMICS LAB**	**0**	**1**	**2**	**1.5**

	Course objectives: The objectives of the course are to
1.	To supplement the principles learnt in kinematics and Dynamics of Machinery.
2.	To understand how certain measuring devices are used for dynamic testing.

Course Outcomes: On successful completion of the course, the student will be able to,	
1.	Ability to demonstrate the principles of kinematics and dynamics of machinery
2.	Determine the Mass moment of inertia, Range sensitivity.
3.	Drawing of Cam profile, determination of torsional, undamped and damped natural frequencies.
4.	Determining of influence of coefficient and balancing of rotating , reciprocating masses.
5.	Verify the laws of springs and forced vibration of cantilever beam.

LIST OF EXPERIMENTS

1. Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.
2. Determination of Mass moment of inertia of Fly wheel and Axle system.
3. Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.
4. Cams – Cam profile drawing, Motion curves and study of jump phenomenon.
5. Determination of torsional natural frequency of single Rotor systems. Un damped and Damped Natural frequencies.
6. Determination of torsional natural frequency of Double Rotor systems. Un damped and Damped Natural frequencies.
7. Multi degree freedom suspension system – Determination of influence coefficient.
8. Determination of torsional natural frequency of single and Double Rotor systems.- Un damped and Damped Natural frequencies.
9. Balancing of rotating masses.
10. Balancing of reciprocating masses.
11. Determination of natural Frequency and verification of Laws of springs
12. Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.

B. TECH-ME-III-I Sem

		L	T	P	C
23A03507	**MACHINE TOOLS & METROLOGY LAB**	**0**	**1**	**2**	**2**

Course objectives: The objectives of the course are to	
1	To understand the parts of various machine tools and about different shapes of products that can be produced on them.
2	To measure bores, angles and tapers
3	To perform alignment tests on various machines

Course Outcomes: At the end of the course, student will be able to	
CO1	Gain knowledge about the parts of various machine tools and about different shapes of products that can be produced on them.
CO2	Learn measure bores, angles and tapers
CO3	Perform alignment tests on various machines

Note: The students have to conduct at least 6 experiments from each lab

MACHINE TOOLS LAB

1. .Introduction of general purpose machines -Lathe, Drilling machine, Milling machine, Shaper, Planing machine, Slotting machine, Cylindrical grinder, Surface grinder and Tool and cutter grinder.
2. Operations on Lathe machines- Step turning, Knurling, Taper turning,Thread cutting and Drilling
3. Operations on Drilling machine - Drilling, reaming, tapping, Rectangular drilling, circumferential drilling
4. Operations on Shaping machine - (i) Round to square (ii) Round to Hexagonal
5. Operations on Slotter - (i) Keyway (T –slot) (ii) Keyway cutting
6. Operations on milling machines - (i) Indexing (ii) Gear manufacturing

METROLOGY LAB

1. Calibration of vernier calipers, micrometers, vernier height gauge and dial gauges.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier caliper for tooth thickness inspection and flange micrometer for checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.

5. Machine tool alignment test on drilling machine.
6. Machine tool alignment test on milling machine.
7. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
8. Use of spirit level in finding the straightness of a bed and flatness of a surface.
9. Thread inspection with two wire/ three wire method & tool makers microscope.
10. Surface roughness measurement with roughness measuring instrument.

Online Learning Resources:

1. https://www.youtube.com/watch?v=sG6GCfX7L3c&pp=ygUeTWFjaGluZSBUb29scyAgbGFiIGV4cGVyaW1lbnRz
2. https://www.youtube.com/watch?v=mafthRhz1iM&pp=ygUeTWFjaGluZSBUb29scyAgbGFiIGV4cGVyaW1lbnRz
3. https://www.youtube.com/watch?v=5--saq-oYBE&list=PLrcSDk_gQ7jiQCfWEzw93ZMaxHkg2v-CC
4. https://www.youtube.com/watch?v=m60m2TcbTgc&pp=ygUZbWV0cm9sb2d5IGxhYiBleHBlcmltZW50cw%3D%3D

B. TECH-ME-III-I Sem

		L	T	P	C
23A03508	**TINKERING LAB**	**2**	**0**	**0**	**1**

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course objectives: The objectives of the course are to	
1	**Encourage Innovation and Creativity**
2	**Provide Hands-on Learning and Impart Skill Development**
3	**Foster Collaboration and Teamwork**
4	**Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship**
5	**Impart Problem-Solving mind-set**

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Design and 3D print a Walking Robot
3) Design and 3D Print a Rocket.
4) Temperature & Humidity Monitoring System (DHT11 + LCD)
5) Water Level Detection and Alert System
6) Automatic Plant Watering System
7) Bluetooth-Based Door Lock System
8) Smart Dustbin Using Ultrasonic Sensor
9) Fire Detection and Alarm System
10) RFID-Based Attendance System
11) Voice-Controlled Devices via Google Assistant
12) Heart Rate Monitoring Using Pulse Sensor
13) Soil Moisture-Based Irrigation
14) Smart Helmet for Accident Detection
15) Milk Adulteration Detection System
16) Water Purification via Activated Carbon
17) Solar Dehydrator for Food Drying
18) Temperature-Controlled Chemical Reactor
19) Ethanol Mini-Plant Using Biomass
20) Smart Fluid Flow Control (Solenoid + pH Sensor)
21) Portable Water Quality Tester
22) AI Crop Disease Detection
23) AI-based Smart Irrigation
24) ECG Signal Acquisition and Plotting
25) AI-Powered Traffic Flow Prediction
26) Smart Grid Simulation with Load Monitoring

27) Smart Campus Indoor Navigator
28) Weather Station Prototype
29) Firefighting Robot with Sensor Guidance
30) Facial Recognition Dustbin
31) Barcode-Based Lab Inventory System
32) Growth Chamber for Plants
33) Biomedical Waste Alert System
34) Soil Classification with AI
35) Smart Railway Gate
36) Smart Bin Locator via GPS and Load Sensors
37) Algae-Based Water Purifier
38) Contactless Attendance via Face Recognition

- **Note:** The students can also design and implement their own ideas, apart from the list of experiments mentioned above.
- **Note:** A minimum of 8 to 10 experiments must be completed by the students.

B. TECH-ME-III-I Sem

		L	T	P	C
23A03509	**COMMUNITY SERVICE PROJECT** **Experiential learning through community engagement**	**0**	**0**	**0**	**2**

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in a 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty incharge.

- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
- First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
- Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like.
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

EXPECTED OUTCOMES

BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water

29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are;

Programmes for School Children

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programmes for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

Programmes for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco

4. Awareness on Competitive Examinations
5. Personality Development

Common Programmes

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture
    vi. Fisheries
    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
    xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. **Preliminary Survey (One Week)**
   - A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
   - A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
   - The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. **Community Awareness Campaigns (One Week)**
   - Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. **Community Immersion Programme (Three Weeks)**

   Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. **Community Exit Report (One Week)**
   - During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

   Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

B. TECH-ME-III-II Sem

23A03601T	HEAT TRANSFER	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	Understand the concept of heat transfer mechanisms, focusing on steady and unsteady state heat conduction, include practical applications.
2	Define fundamental principles and types of convective heat transfer, enabling to understand and apply empirical correlations for analyzing heat transfer in both internal and external flows.
3	Knowledge on the mechanisms and regimes of boiling and condensation, emphasizing the heat transfer characteristics and practical implications of each.
4	Design and analysis of various types of heat exchangers, including performance evaluation using LMTD and NTU methods.
5	Demonstrate the principles of thermal radiation and mass transfer, including fundamental laws, radiation exchange, and diffusion mechanisms in gases and liquids.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Analyze and solve heat conduction problems in various systems, including steady and transient conditions, using appropriate mathematical models and charts.	*L3,L5,L6*
2	Evaluate convective heat transfer in various systems by applying boundary layer theory and empirical correlations for practical engineering problems.	*L2,L3,L5*
3	Analyze and distinguish between different boiling regimes and condensation modes, and solve related heat transfer problems in engineering applications.	*L2,L4,L5*
4	Design and evaluation different heat exchanger configurations, by analysing appropriate methods.	*L4,L5,L6*
5	Apply radiation laws and mass transfer principles to analyze and solve problems involving radiative heat exchange and diffusive transport in engineering systems.	*L3,L4,L5*

UNIT I: Introduction

Basic modes of heat transfer- rate equations- generalized heat conduction equation-various forms - steady state heat conduction solution for plane and composite slabs - cylinders - critical thickness of insulation- heat conduction through fins of uniform cross section- fin effectiveness and efficiency.

Unsteady State Heat Transfer Conduction- Transient heat conduction- lumped system analysis and use of Heisler charts.

UNIT II : Convection

Convection: Basic concepts of convection–heat transfer coefficients - types of convection – forced convection and free convection.

Free Convection: development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for convective heat transfer on plates and cylinders in horizontal and vertical orientation

Forced convection: In external flow–concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders. Fluid friction – heat transfer analogy, approximate solution to laminar boundary layer equation for external flow. Internal flow – Use of empirical relations for convective heat transfer in horizontal pipe flow-problems.

UNIT III

Boiling and Condensation

Different regimes of boiling- nucleate, transition and film boiling – condensation – film wise and drop wise condensation-problems.

UNIT IV

Heat Exchangers

Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods- fouling in heat exchangers-problems.

UNIT V

Radiation: Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies – shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect- simple problems.

Mass Transfer: Conservation laws and constitutive equations - Fick's law of diffusion, isothermal equi-mass - Equimolal diffusion- - diffusion of gases and liquids- mass transfer coefficient.

Textbooks:

1. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.
2. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill, 2008.
3. R.C.Sachdeva, Fundamentals of Engineering Heat & Mass transfer, New Age International Publishers, 2017.

Reference Books:

1. F. P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6/e, John Wiley, 2007.
2. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.

3. S.P. Sukhatme, A Text book of Heat Transfer, Universities Press, 2005.
4. S. C. Arora& S. Domkundwar , A Course in Heat and Mass Transfer, Dhan pat Rai & CO.(P) LTD-Delhi , 2007.
5. C.P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer data book, New Age Publications, 2014.
6. Er.R.K.Rajput, A Text book of Heat & Mass Transfer, S.Chand publishers,1/e,2018.

Online Learning Resources:

- https://ocw.mit.edu/courses/mechanical-engineering/2-051-introduction-to-heat-transfer-fall- 2015/
- https://www.udemy.com/topic/heat-transfer/
- https://www.youtube.com/watch?v=TWTQx3W-2k8
- https://onlinecourses.nptel.ac.in/noc20_ch21/preview
- https://ekeeda.com/degree-courses/mechanical-engineering/heat-transfer
- https://www.coursera.org/lecture/thermodynamics-intro/02-04-heat-transfer-gyDfJ
- https://www.youtube.com/watch?v=cjJ2LV5lkB8

B. TECH-ME-IV-I Sem

		L	T	P	C
23A03602T	**CAD/CAM (Professional Core)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Understand the basic of CAD/CAM. Explore graphics standards and analyze 2D and 3D geometric transformations.
2	Knowledge and skills to apply various geometric modeling techniques, as well as solid modeling approaches.
3	Explain the principles of Computer Aided Manufacturing (CAM), numerical control (NC), and the functionalities of CNC and DNC systems.
4	Design and develop a part programming using G/M codes and APT for various machining operations.
5	Explain the basics of automation systems, robotics, group technology, CIM, and emerging trends like VR, AR, and AI.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Apply and Evaluate the CAD/CAM principles to design and manufacturing processes. Create and manipulate CAD models using appropriate software tools.	*L3,L4,L5*
2	Analyze and differentiate between Hermite, Bezier, and B-spline curves and construct and manipulate surface models. Evaluate the effectiveness of Boolean operations and create complex geometric models.	*L2,L3,L5, L6*
3	Identify and analyze key components of NC and CNC systems in manufacturing processes. Evaluate the performance of DNC systems in a manufacturing environment.	*L1,L2,L3, L4,L5*
4	Explain the structure and functioning of NC/CNC/DNC machine tools and adaptive control systems. Develop part programs using standard codes and APT for basic machining operations.	*L2,L6*
5	Understand and evaluate the role of robotics, group technology, and CIM in modern manufacturing systems, and explain emerging technologies like VR, AR, and AI.	*L2,L5*

UNIT –I

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, clipping, hidden line / surface removal color, shading.

UNIT –II

Geometric Modeling: Representation techniques, Parametric and non-parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations. Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry representations

UNIT- III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining center, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Nodes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

UNIT -IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.
Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non-optical, integration of CAQC with CAD and CIM.

UNIT- V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits Machinability data systems, Computer generated time standards.

Computer integrated production planning: Capacity planning, shop floor control, MRP-I, MRP-II, CIMS benefits. Trends in manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Textbooks:

1. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008.
2. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, 2/e, Tata McGraw-Hill, Delhi, 2009.

Reference Books:

1. P. N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017.
2. P. Radhakrishnan, S. Subramanyan& V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008.
3. Computer Aided Manufacturing, 3/e, Tien Chien Chang, Pearson, 2008.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc20_me44/preview
- https://www.youtube.com/watch?v=EgKc9L7cbKc
- https://www.youtube.com/watch?v=KXFpTb9cBpY
- https://web.iitd.ac.in/~hegde/cad/lecture/L01_Introduction.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1530947994.pdf
- https://www.iare.ac.in/sites/default/files/lecture_notes/CAD_CAM_LECTURE_NOTES.pdf

B. TECH-ME-III-II Sem

23A03603	DESIGN OF MACHINE MEMBERS	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	Understanding of the mechanical engineering design process for static and dynamic loads under various loading conditions.
2	Explore the design principles and analysis of bolted and welded joints and butt welds under various loading conditions.
3	Study the design principles of power transmission shafts and couplings, focusing on the analysis of shafts subjected loads, as well as the design of various types of couplings.
4	Explain the design principles of friction clutches, brakes, and springs, design of different brakes, clutches, helical and leaf springs under various loading conditions.
5	Demonstrate the design principles of sliding and rolling contact bearings, gears, spur gears, beam strength, and load considerations.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Apply design principles for components subjected to static and dynamic loads, analyze and design for fatigue failure using relevant criteria	*L3,L4,L6*
2	Design and analyze bolted and welded joints, considering factors such as different types of loads, including eccentric loading scenarios.	L2,L4,L6
3	Design power transmission shafts and couplings for fluctuating loads, and selecting appropriate couplings such as flange, bushed pin, and universal couplings.	L4,L5,L6
4	Design friction clutches, brakes, and springs, applying the various theories and analyze the working for mechanical applications.	L2,L4,L6
5	Design and analyze the sliding and rolling contact bearings, spur gears, considering beam strength, dynamic, and wear load factors.	L3,L4,L6

UNIT I

Introduction, Design for Static and Dynamic loads

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials.

Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

UNIT II

Design of Bolted and Welded Joints

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints.

Welded Joints: Strength of lap and butt welds, Joints subjected to bending and torsion. Eccentrically loaded welded joints.

UNIT III

Power transmission shafts and Couplings

Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

Couplings: Design of flange and bushed pin couplings, universal coupling.

UNIT IV

Design of Clutches, Brakes and Springs

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

Springs: Design of helical compression, tension, torsion and leaf springs.

UNITV

Design of Bearings and Gears

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

Design of Gears: Spur gears, beam strength, Lewis equation, design for dynamic and wear loads.

Textbooks:

1. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004.
2. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.

Reference Books:

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.
4. K. Mahadevan &K.Balaveera Reddy, Design data handbook, CBS Publications, 4/e, 2018.
5. Dr. N. C. Pandya &Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.

Online Learning Resources:

- https://www.yumpu.com/en/document/view/18818306/lesson-3-course-name-design-of- machine-elements-1-nptel
- https://www.digimat.in/nptel/courses/video/112105124/L01.html
- https://dokumen.tips/documents/nptel-design-of-machine-elements-1.html
- http://www.nitttrc.edu.in/nptel/courses/video/112105124/L25.html

B. TECH-ME-III-II Sem

		L	T	P	C
23A03604a	**ENGINEERING FRACTURE MECHANICS (Professional Elective-II)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Understanding of Engineering Fracture Mechanics (EFM principles and fatigue crack growth models, with a focus on analyzing and preventing spectacular structural failures.
2	Explore the principles of crack growth and fracture mechanisms, and their applications in material failure analysis.
3	Review the theory of elasticity and explore Westergaard's solution for stress and displacements in Mode I fracture, along with the relationship between the stress intensity factor (K) and the energy release rate (G).
4	Familiarize multi-parameter stress fields for Mode I, Mode II, and mixed-mode fractures, explore the calculation of stress intensity factors (SIF) for various geometries
5	To study fracture toughness testing, crack growth models, analysis, failure assessment diagrams, and mixed-mode fracture, along with methods for crack arrest and repair.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Apply LEFM, EPFM, and fatigue crack growth models to assess and prevent catastrophic structural failures at different loads.	*L2,L3,L5*
2	Apply Griffith's theory, calculate energy release rates, and analyze crack propagation mechanisms in materials to predict and prevent fractures in engineering applications.	L3,L4,L5
3	Analyze and apply the theory of elasticity and displacement in Mode I fracture, and understand the connection between the stress intensity factor (K) and the energy release rate (G).	L2,L3,L4
4	Analyze and calculate multi-parameter stress fields for different fracture modes and apply Irwin's and Dugdale's models to understand deformation around crack tips.	L2,L4,L5
5	Perform fracture toughness testing, apply crack growth models, and understand crack closure and failure assessment diagrams.	L2,L3,L5

UNIT 1

EFM Course outline and Spectacular Failures, Introduction to LEFM and EPFM, Fatigue Crack Growth Model

UNIT 2

Crack Growth and Fracture Mechanisms, Griffith TMs Theory of Fracture, Energy Release Rate

UNIT 3

Review of Theory of Elasticity , Westergaard Solution for Stress and Displacements for Mode I, Relationship between K and G

UNIT 4

Introduction to multi parameter stress field for Mode I, Mode II and Mixed Modes, SIF for Various Geometries, Modeling Plastic Deformation, Irwin TMs model, Dugdale Model

UNIT 5

Fracture Toughness Testing, Paris Law and Sigmoidal curve, Crack Closure, Crack Growth Models, J-Integral, Failure Assessment Diagram, Mixed Mode Fracture, Crack Arrest and Repair Methodologies

Text Books

1. Prashant Kumar, Elements of Fracture Mechanics, Tata McGraw Hill, New Delhi, India, 2009.
2. K. R.Y. Simha, Fracture Mechanics for Modern Engineering Design, Universities Press (India) Limited,2001.

Reference Books

1. D. Broek, Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers, Dordrecht, 1986.
2. T.L. Anderson, Fracture Mechanics "Fundamentals and Applications, 3rd Edition, Taylor and Francis Group, 2005.
3. K. Ramesh, e-Book on Engineering Fracture Mechanics, IIT Madras, 2007.

Online Learning Resources:

1. https://nptel.ac.in/courses/112106065
2. https://youtube.com/playlist?list=PLA218B83235A4AD5C&si=XI175OWGIvdMCQH9
3. https://youtube.com/playlist?list=PLA218B83235A4AD5C&si=ruHP1MIsJGNAyMYV
4. https://youtube.com/playlist?list=PLfIFNJ1DPG4ks5AjeCgpbm8nLGM1Pgxer&si=F-fj413KzPAkjPSs

B. TECH-ME-III-II Sem

23A03604b	INTRODUCTION OF TURBO MACHINERY (Professional Elective-II)	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	Understanding of the principles, classifications, and governing equations of turbo machinery.
2	Familiarize of gas turbine cycles including Brayton, regenerative, reheat, and inter-cooling processes, as well as the operation and performance of turboprop, turbojet, and turbofan engines with thrust augmentation techniques.
3	Principles of similarity analysis and cascade theory in turbo machinery, for performance evaluation of compressor and turbine blades.
4	Design and analysis of axial and centrifugal compressors and pumps, considering different parameters.
5	Develop a thorough understanding of axial flow turbine design and performance parameters, and to introduce computational fluid dynamics (CFD) as a tool for analyzing turbo machinery.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Analyze and apply the fundamental concepts of fluid motion in rotating systems to design and evaluate the performance of various turbo machines.	*L3,L4,L5,*
2	Compare, Analyze, and evaluate various gas turbine cycles and engine configurations for optimum propulsion and power generation applications.	L2,L4,L5
3	Apply similarity principles and cascade analysis techniques to evaluate blade performance, estimate aerodynamic losses, and optimize turbo machine blade designs.	L3,L4,L5
4	Design, analyze, and evaluate the performance of axial and centrifugal compressors and pumps, and thermodynamic principles for improved efficiency and functionality.	L4,L5,L6
5	Create and evaluate axial flow turbines and apply CFD techniques to simulate and analyze fluid flow and thermal behavior in turbo machinery systems.	L4,L5,L6

UNIT 1

Introduction and Classification: Axial flow, radial flow and mixed flow machines, the equations of motion in rotating frame of reference, effects of Coriolis and Centrifugal forces, momentum and energy equation, Euler work and illustrative examples.

UNIT 2

Gas Turbine Cycle: Brayton Cycle, regenerative cycle, reheat, inter-cooling, turboprop, turbojet and turbofan engine, thrust augmentation and illustrative examples.

UNIT 3

Similarity Analysis: Similarity rules, specific speed, Cordier diagram and illustrative examples. Cascade Analysis: Two-dimensional cascade theory, lift and drag, blade efficiency, estimation of loss, compressor and turbine cascade, blade geometry and illustrative examples.

UNIT 4

Axial Flow Compressor: Two-dimensional pitch line design and analysis, h-s diagram, degree of reaction, the effect of Mach number, performance and efficiency, three-dimensional flow, tip clearance, losses, compressor performance and illustrative examples.

Centrifugal Pump and Compressor: Theoretical analysis and design, the effect of circulation and Coriolis forces, reversal eddies, slip factor, head and efficiency, diffuser, introduction to the combustion system and illustrative examples.

UNIT 5

Axial Flow Turbine: Two-dimensional pitch line design, stage loading capacity, degree of reaction, stage efficiency, turbine performance, blade cooling, and illustrative examples.. CFD Applied to Turbomachinery Flows: Governing equations, numerical methods, and test cases illustrating flow and heat transfer related to turbo machines.

Text Books:

1. Fluid Mechanics and Thermodynamics of Turbomachinery, S. L. Dixon and C. A. Hall, Butterworth-Heinemann, Seventh Edition, 2014.
2. Gas Turbine Theory, H. Cohen, GFC Rogers and HIH Saravanamuttoo, Addison Wesley Longman Limited, 4th Edition, 1996.

Reference Books:

1. Fundamentals of Turbomachinery, Venkanna B. K Prentice Hall India Learning Private Limited, 2009.
2. Principles of Turbomachinery, Seppo A. Korpela, 2nd Edition, (2019) John Wiley and Son's, USA.

Online Learning Resources:

1. https://youtube.com/playlist?list=PLbMVogVj5nJQQp3QLuzbcHrt0XncZZTiE&si=ts0mwl6etWcmKO1i
2. https://youtube.com/playlist?list=PLWCscP8J8VQ4i0BoPCAgP5mXQh9VWmyuS&si=cLzUxZke5BJV-lUg
3. https://youtube.com/playlist?list=PLbMVogVj5nJQQp3QLuzbcHrt0XncZZTiE&si=Rzs-PEl9nqP45rKe

B. TECH-ME-III-II Sem

		L	T	P	C
23A03604c	**CONTROL SYSTEMS (Professional Elective-II)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Fundamentals of control systems, mathematical modeling, and transfer function derivation for electro-mechanical components.
2	Knowledge on system representation, and to introduce classical control design techniques.
3	To equip students with the ability to represent and simplify control, and to design effective controllers for achieving desired system performance.
4	Knowledge and skills to analyze control system stability and performance in the frequency domain, using Bode, polar, and transfer functions.
5	State-space analysis of different models from block diagrams, and concepts of controllability, observability, and state transition matrices.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Model dynamic systems, distinguish between loop controls, analyze feedback effects, and derive transfer functions for DC/AC servo motors and synchro devices.	*L1,L2,L4*
2	Analyze and simplify control systems, and create effective controllers such as lag, lead, lead-lag, and PID to meet system performance specifications.	L2,L4,L6
3	Analyze and simplify control systems using block diagrams and signal flow graphs, and design appropriate controllers to achieve desired system performance.	L3,L4,L6
4	Analyze the frequency response of control systems using Bode, polar, and evaluate system stability and performance such as gain margin and phase margin.	L1,L4,L5
5	Develop state-space models from block diagrams, analyze system controllability and observability, and solve time-invariant state equations using the state transition matrix.	L2,L4,L6

UNIT - I

BASICS IN CONTROL SYSTEM AND TRANSFER FUNCTION: Introduction of Control Systems, Various types of systems (Open Loop and closed loop) and their differences- Classification and Feed-Back Characteristics of control system- Effects of feedback. Mathematical models – Differential equations, Translational and Rotational mechanical systems. Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver.

UNIT - II

REPRESENTATION OF TRANSFER FUNCTION AND CONTROL DESIGN TECHNIQUES: Block diagram representation of systems considering electrical systems as examples. Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula. Compensation techniques – Lag, Lead, Lead-Lag Controllers design, PID Controllers.

UNIT - III

TIME RESPONSE ANALYSIS: Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems. STABILITY ANALYSIS: The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability. The root locus concept - construction of root locieffects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT - IV

FREQUENCY RESPONSE ANALYSIS: Introduction, Frequency domain Specifications-Bode diagrams Determination of Frequency domain specifications and transfer function from the Bode Diagram-Phase margin and Gain margin Stability Analysis from Bode Plots. **STABILITY ANALYSIS IN FREQUENCY DOMAIN**: Polar Plots-Nyquist Plots-Stability Analysis.

UNIT - V

STATE SPACE ANALYSIS: Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

TEXT BOOKS:

1. I. J. Nagrath, M .Gopal (2011), Control Systems Engineering, 5th edition, New Age International (P) Limited, New Delhi, India.
2. Benjamin. C. Kuo (2003), Automatic Control Systems, 8th edition, John Wiley and Son's, USA.

REFERENCE BOOKS:

1. K. Ogata (2008), Modern Control Engineering, 4th edition, Prentice Hall of India Pvt. Ltd, New Delhi. 2. N. K. Sinha (2008), Control System.
2. Prof. Vishwajit K. Barbudhe Control system Engineering National Press (2020)
3. Richard Dorf and Robert Bishop Modern Control Systems Pear son, 13th edition (2016)

Online Learning Resources:

1. https://nptel.ac.in/courses/107106081
2. https://nptel.ac.in/courses/108107115
3. https://nptel.ac.in/courses/108103007
4. https://nptel.ac.in/courses/115108104

B. TECH-ME-III-II Sem

23A03604d	**OPERATIONS RESEARCH (Professional Elective-II)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Understanding of OR, focusing on model classification, formulation, and solution techniques for LP problems.
2	Knowledge and techniques for formulating and solving transportation and assignment problems, and the Traveling Salesman Problem.
3	Fundamentals of game theory and job sequencing, including optimal strategies, and scheduling techniques.
4	Demonstrate of queuing theory, queuing models based on Poisson arrivals and exponential service times, and the analysis of single and multichannel systems with various queue lengths.
5	Familiarize replacement and maintenance strategies, fundamentals of dynamic programming and its applications in optimization problems.

Course Outcomes (Learning Outcomes): On successful completion of this course, the student will be able to		
1	Build and compare different mathematical models of the real time situations by using different Research models. Solve the LP problems and find Multiple Optimal Solutions.	L3, L2,L5
2	Implement Transportation and Assignment problems to solve the real time industry needs.	L1,L3,L5
3	Choose the best strategy of Game theory and capable of identifying the suitable techniques .Solve the Job Sequencing Problem.	L2,L3, L5
4	Apply different Queuing models to optimize the queuing length. Define the queuing and inventory terminology to solve the different inventory and queuing problems.	L1, L3,L6
5	Apply concepts of replacement and maintenance analysis and solve optimization problems using dynamic programming techniques.	L3,L4,L5

UNIT I

Introduction to OR

Introduction to Operations Research (OR): OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models

Linear Programming(LP): Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem

UNIT – II

Transportation and Assignment Problems

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution –North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, Degenerate Problem. Assignment Problem – Formulation, Hungarian Method for Solving Assignment Problems, Traveling Salesman problem.

UNIT – III

Game theory & Job Sequencing

Game theory: Optimal solution of two person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies. Reduction by principles of dominance, arithmetic, algebraic method and graphical method.

Job Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Job Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

UNIT – IV

Queuing Theory & Inventory Control

Queuing Theory: Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with infinite and finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with infinite queue length.

Inventory Control: Introduction, Deterministic models – EOQ model with and without shortages, Production model, Buffer stock and discount inventory models with single price breaks. Selective inventory control.

UNIT – V

Replacement and Maintenance Analysis & DP

Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model. **Dynamic Programming (DP):** Introduction –Bellman's Principle of Optimality – Applications of Dynamic Programming – Shortest Path Problem – Capital Budgeting Problem – Solution of Linear Programming Problem by DP.

Textbooks:

1. Sharma S.D., Operations Research: Theory, Methods and Applications, 15/e, Kedar Nath Ram Nath, 2010
2. Taha H.A., Operations Research, 9/e, Prentice Hall of India, New Delhi, 2010.

Reference Books:

1. Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7/e, Tata McGraw Hill, 2010.
2. Sharma J.K., Operations Research: Theory and Applications, 4/e, Laxmi Publications, 2009.
3. Prem kumar Gupta and Hira, Operations Research, 3/e, S Chand Company Ltd., New Delhi, 2003.
4. Pannerselvam R., Operations Research, 2/e, Pentice Hall of India, New Delhi, 2006.
5. Sundaresan.V, and Ganapathy Subramanian.K.S, Resource Management Techniques: Operations Research, A.R Publications, 2015.

Online Learning Resources:

- http://www2.informs.org/Resources/
- http://www.mit.edu/~orc/
- http://www.ieor.columbia.edu/
- http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
- http://www.wolfram.com/solutions/OperationsResearch/

B. TECH-ME-III-II Sem

		L	T	P	C
23A03604e	**SMART MATERIALS (Professional Elective-II)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Fundamental characteristics of different metals and provide an understanding of smart materials, their classification and real-world applications.
2	Knowledge of various types of smart materials and electro rheological fluids, and shape memory materials.
3	Processing techniques of various smart materials, and smart fluids, with a focus on synthesis and fabrication methods such as metallization and UV curing.
4	Understanding of various types of sensors, and advanced sensors such as carbon nanotube and polymer-based sensors.
5	Principles, types, and applications of actuators used in smart systems, and electro thermal actuators.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Understand and distinguish between traditional engineering materials and smart materials, and identify appropriate smart materials for various engineering applications.	*L1,L2,L3*
2	Explain the working principles, properties, and applications of different smart materials and evaluate their suitability for specific engineering and technological applications.	L2,L3,L5
3	Understand and apply suitable processing and fabrication techniques for different smart materials in engineering applications.	L1,L2,L3
4	Identify, describe, and equate different sensor technologies and select appropriate sensors for engineering applications.	L1,L2,L5
5	Demonstrate the working mechanisms of various actuators compare and select suitable actuation methods for different smart materials for create system applications.	L2,L3,L6

UNIT-1

Introduction

Characteristics of metals, polymers and ceramics. Introduction to smart materials. Classification of smart materials, Components of a smart System, Applications of smart material.

UNIT-2

Smart Materials Piezoelectric materials, Electro strictive Materials, Magnetostrictive materials, Magnetoelectric materials, Magnetorheological Electrorheological fluids, Shape Memory materials.

UNIT-3

Processing of Smart Materials Semiconductors and their processing, Metals and metallization techniques, Ceramics and their processing, Polymers and their synthesis, UV radiation curing of polymers, fluids.

UNIT-4

Sensors Introduction, Conductometric sensors, Capacitive sensors, Piezoelectric sensors, Magnetostrictive sensors, Piezoresistive sensors, Optical sensors, Resonant sensors, semiconductor-based sensors, Acoustic sensors, polymerize sensors, Carbon nanotube sensors.

UNIT-5

Actuators Introduction, Electrostatic transducers, Electromagnetic transducers, Electrodynamic transducers, Piezoelectric transducers, Electro-strictive transducers, Magneto-strictive transducers, Electro thermal actuators, Comparison of actuation, Applications

Text Books:

1. Smart Material Systems and MEMS: Design and Development Methodologies, V. K. Varadan, K. J. Vinoy, S. Gopalakrishnan, John Wiley and Sons, England, 2006.

2. Smart Structures and Materials, Brain Culshaw, Artech House, London, 1996.

3. Smart Materials and Structures, Mukesh V. Gandhi, Brian S. Thompson, , Springer, May-1992.

Reference Books:

1. Smart Structures: Analysis and Design, A. V. Srinivasan, Cambridge University Press, Cambridge, New York, 2001.
2. Smart Structures, P. Gauenzi, Wiley, 2009.
3. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, Berlin, New York, 2002.
4. Analysis and Performance of Fiber Composites, B. D. Agarwal and L. J. Broutman, John Wiley & Sons.
5. Engineering aspects of Shape memory Alloys, T. W. Duerig, K. N. Melton, D. Stockel,C.
6. Mayman, Butterworth – Heinemann, 1990.

Web Resources:

1. https://nptel.ac.in/courses/112104173/
2. www.iop.org/EJ/article/0964-1726/5/3/002/sm6301.ps.gz

MOOCs:

1. https://nptel.ac.in/courses/112104173/
2. https://nptel.ac.in/courses/112104251/

B. TECH-ME-III-II Sem

		L	T	P	C
23A03605a	**APPLICATIONS OF COMPUTATIONAL FLUID DYNAMICS (Professional Elective-III)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Foundation in numerical techniques, and finite element methods for solving partial differential equations under various boundary conditions.
2	Solid understanding of numerical methods for solving time-dependent partial differential equations, with emphasis on stability and accuracy analysis.
3	To introduce students to numerical formulations for incompressible and compressible viscous flows using finite difference and advanced computational techniques, enabling them to model and analyze fluid flow problems governed by the Euler and Navier-Stokes equations.
4	Knowledge and skills to apply the finite volume method using finite difference formulations for solving two- and three-dimensional fluid flow and heat transfer problems.
5	Understand the concepts of linear fluid flow problems, steady state problems and transient problems.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Formulate and solve partial differential equations using finite element methods, apply and analyze the stability, accuracy of explicit and implicit methods.	*L2,L3,L4*
2	Apply and analyze explicit and implicit numerical schemes, solve nonlinear and second-order PDEs, using appropriate numerical techniques.	L3,L4,L5
3	Create and solve incompressible and compressible viscous flow problems, apply appropriate boundary conditions.	L2,L5,L6
4	Develop and implement finite volume formulations based on finite difference methods, ensuring accurate and conservative solutions in CFD applications.	L1,L3,L6
5	Analyze and solve linear fluid flow problems, using appropriate numerical methods and interpret the physical significance of the computed results.	L1,L4,L5

UNIT I

Introduction and Solution methods

Introduction: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT II

Hyperbolic equations:

Hyperbolic equations:explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

UNIT III

Formulations Of Incompressible Viscous Flows

Formulations Of Incompressible Viscous Flows: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods.

Treatment of compressible flows: potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT IV

Finite Volume Method:

Finite Volume Method Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT V

Standard Variational Methods:

Standard Variational Methods Linear fluid flow problems, steady state problems, Transient problems.

Textbooks:

1. T. J. C'hung, Computational fluid dynamics, Cambridge University press,2002.
2. John D. Anderson, Computational Fluid Dynamics: Basics with applications, Mc Graw Hill. 2017

Reference Books:

1. Frank Choriton, Text book of fluid dynamics, CBS Publishers & distributors, 1985.
2. Suhas V. Patankar, Numerical heat transfer and fluid flow, Hema shava Publishers corporation & Mc Graw Hill, 1990.
3. Muralidaran, Computational Fluid Flow and Heat Transfer, Narosa Publications, 2003.
4. Tapan K. Sengupta, Fundamentals of Computational Fluid Dynamics, Universities Press, 2004.
5. C. Pozrikidis, Introduction to Theoretical and Computational Fluid Dynamics, Oxford University press, 2/e, 2012.

Online Learning Resources:

- https://nptel.ac.in/courses/112107079
- https://www.youtube.com/watch?v=3QFT7pGx03I
- https://www.youtube.com/watch?v=t7jS7V_6TGQ
- https://nptel.ac.in/courses/112107080

B. TECH-ME-III-II Sem

		L	T	P	C
23A03605b	**INDUSTRIAL SAFETY (Professional Elective-III)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Understand the concepts of industrial safety and management.
2	Demonstrate the accident preventions and protective equipment.
3	Understand and apply the knowledge of safety acts
4	knowledge about fire prevention and protection systems
5	Understand and apply fire safety principles in buildings

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Students learn the concepts of industrial safety and management.	*L2*
2	Learn about the smart machines and smart sensors	L1,L2
3	Apply IoT to Industry 4.0 and they are able to make a system tailor-made as per requirement of the industry	L4,L5
4	Students learn about fire prevention and protection systems.	L2,L3
5	Students learn and apply the fire safety principles in buildings	L2,L4

UNIT-I

INTRODUCTION TO THE DEVELOPMENT OF INDUSTRIAL SAFETY AND MANAGEMENT: History and development of Industrial safety: Implementation of factories act, Safety and productivity, Safety organizations. Safety committees and structure, Role of management and role of Govt.in industrial safety.

UNIT-II

ACCIDENT PREVENTIONS AND PROTECTIVE EQUIPMENT: Personal protective equipment, Survey the plant for locations, Part of body to be protected, Education and training in safety, Prevention causes and cost of accident, Housekeeping, First aid, Accident reporting, Investigations. Industrial psychology in accident prevention, Safety trials, Safety related to operations.

UNIT-III

SAFETY ACTS: Features of Factory Act, Introduction of Explosive Act, Boiler Act, ESI Act, Workman's compensation Act, Industrial hygiene, Occupational safety, Diseases prevention, Ergonomics, Occupational diseases, stress, fatigue, health, safety and the physical environment, Engineering methods of controlling chemical hazards, safety and the physical environment, Control of industrial noise and protection against it, Code and regulations for worker safety and health, codes for safety of systems.

UNIT-IV

FIRE PREVENTION AND PROTECTION: Sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E-Fire extinguishing agents- Water, Foam, Dry chemical powder, Carbon-dioxide Halon alternatives Halocarbon compounds-Inert gases, dry powders – types of fire extinguishers – fire stoppers –hydrant pipes – hoses – monitors – fire watchers – layout of stand pipes – fire station-fire alarms and sirens – maintenance of fire trucks – foam generators – escape from fire rescue operations – fire drills –first aid for burns.

UNIT-V

BUILDING FIRE SAFETY: Objectives of fire safe building design, Fire load, fire resistant material and fire testing – structural fire protection – structural integrity – concept of egress design -exit– width calculations – fire certificates – fire safety requirements for high rise buildings.

TEXT BOOKS:

1. Occupational Safety Management and Engineering Willie Hammer–PrenticeHall (2000)
2. Purandare D.D & Abhay D.Purandare, "Handbook on Industrial Fire Safety" P&A publications, NewDelhi, 2006.

REFERENCE BOOKS:

1. Installation, Servicing and Maintenance Bhattacharya, S.N.-S.Chandand Co.
2. Jain VK "Fire Safety in Building" New Age International 1996.
3. Reliability, Maintenance and Safety Engineering by Dr.A. K.Guptha
4. A Text book of Reliability and Maintenance Engineering by Alakesh Manna
5. McElroy,FrankE.,"Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1988.
6. Green, A.E.,"High Risk Safety Technology", John Wiley and Sons, 1984.

Online Learning Resources:

https://nptel.ac.in/courses/110105094

https://youtube.com/playlist?list=PLbRMhDVUMngdXebaRB59KdKwstzuAovua&si=FcbDQzZK6i_3TASD

https://youtube.com/playlist?list=PLbRMhDVUMngdXebaRB59KdKwstzuAovua&si=6RaMiYhEkp5-EfAH

https://youtube.com/playlist?list=PLln3BHg93SQ8RYKhe9czOHq1hVjpEWMts&si=5y0WMqX3wrvvispq

B. TECH-ME-III-II Sem

		L	T	P	C
23A03605c	**DESIGN OF AUTOMOBILE TRANSMISSION SYSTEMS (Professional Elective-III)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Explain the various elements involved in a transmission system.
2	Focus on the various forces acting on the elements of a transmission system.
3	Design the system based on the input and the output parameters.
4	Produce working drawings of the system involving pulleys, gears, clutches and brakes.
5	Demonstrate the energy considerations in the design of motion control elements.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Design and select suitable flexible power transmission elements and analyze the load conditions, and performance requirements.	*L2,L4,L6*
2	Analyze spur gear geometry and kinematics, and design spur gears for desired power transmission capacity based on bending and contact stress criteria.	L1,L4,L6
3	Analyze and design different types of gears by evaluating their efficiency, ensuring reliable performance in mechanical power transmission systems.	L4,L5,L6
4	Create speed reducers and multi-speed gearboxes by developing structural and ray diagrams, selecting appropriate gear combinations for various mechanical applications.	L2,L3,L6
5	Select, and design various types of clutches and brakes, analyze and choose appropriate friction materials for effective motion control.	L2,L4,L6

UNIT I

Flexible power transmission systems: Design of Belts – Flat Belts and Pulleys – V Belts and Pulleys – Design of chain drives – Wire ropes

Design of bearing: Lubrication- hydrodynamic lubrication theory, Design of sliding contact bearing using Sommer field number – Design using Mckee's equation – Selection of rolling contact bearings.

UNIT II

Spur gear: Gear geometry – Kinematics – Forces on gear tooth – Stresses in Gear tooth – Selection of gear material based on bending stress and contact stress – Design of Spur gear – Power transmitting capacity.

UNIT III

Helical, bevel and worm gears: Parallel Helical Gears – Kinematics – Tooth proportions – Force analysis – Stresses in Helical gear – Design of helical gear – Crossed Helical gears – Straight Bevel gears – Kinematics – Force analysis – Stresses in straight bevel gear tooth – Design of bevel gear – Worm gearing – Kinematics – Forces - Friction and Efficiencies – Stresses in worm gear tooth.

UNIT IV

Design of gear boxes: Design of Speed reducers – Design of multi speed gear boxes for machine tools – Structural and ray diagrams.

UNIT V

Elements of motion control: Internal – Expanding Rim clutches and Brakes – External – Contracting Rim clutches and Brakes – Band type Clutches – Cone clutches and Brakes – Energy considerations – Temperature rise – Friction materials.

TEXT BOOKS:

1. Joseph Edward Shigley and Charles, R. Mischke, "Mechanical Engineering Design", McGraw –Hill International Editions, 2000.
2. Robert L. Norton, "Machine Design"- an integrated approach, (5th Edition) Pearson publisher, 2000

REFERENCES:

1. "Design Data", PSG College of Technology, DPV Printers, Coimbatore, 2005.
2. Malisa, "Hand Book of Gear Design", Tata Mc Graw Hill, International Edition, 2000.
3. V.B. Bhandari ,"Design of Machine Elements", Tata Mc Graw Hill, 2001

Online Learning Resources:

https://youtube.com/playlist?list=PLyqSpQzTE6M-7nTyaGekZRTLLUzGfRPMo&si=Jvicxjkhv8LS6Lt_

https://youtube.com/playlist?list=PLyqSpQzTE6M-7nTyaGekZRTLLUzGfRPMo&si=aFp27b3qPylydjCV

https://youtu.be/ftJKqKuppF4?si=wzfkYJUOeDxWHWRW

B. TECH-ME-III-II Sem

		L	T	P	C
23A03605d	**MECHANICS AND MANUFACTURING OF COMPOSITE MATERIALS (Professional Elective-III)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Fundamentals of composite materials, including their classification, and to familiarize them with various fiber-reinforced plastic processing techniques used in manufacturing.
2	Understanding of the micro- and macro-mechanical behavior of composite laminas.
3	Equip theoretical and analytical tools for evaluating the strength and mechanical behavior of composite laminates
4	Introduce metal matrix composites (MMCs), focusing on reinforcement materials, base metal selection, fabrication techniques.
5	Deep understanding of micromechanics-based failure analysis in unidirectional composite laminas, and the selection of appropriate failure criteria.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Classify and describe the characteristics of different types of composite materials, and explain and apply various fiber-reinforced plastic processing methods.	*L1,L2,L3*
2	Evaluate the elastic moduli of composite laminas, apply Hooke's law to different material types and solve numerical problems.	L3,L4,L5
3	Analyze the failure of composite laminates, and perform macro-mechanical analysis using Classical Laminate Theory (CLT), for various laminate configurations through numerical problem-solving.	L2,L4,L5
4	Identify and select appropriate reinforcements and base metals for MMCs, understand and apply various fabrication processes.	L1,L2,L3
5	Analyze and evaluate the failure mechanisms of unidirectional lamina using micromechanical models and apply suitable failure theories through practical examples.	L3,L4,L5

UNIT I
Introduction to Composite Materials

Introduction to Composite Materials: Definition, classification and characteristics of composite Materials – fibrous composites, laminated composites, particulate composites. **Applications:** Automobile, Aircrafts. missiles. Space hardware, Electrical and electronics, Marine, recreational and sports equipment, future potential of composites.

Fiber Reinforced Plastic Processing: Lay-up and curing, fabricating process, open and closed mould process, hand lay-up techniques; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pulforming, thermo-forming, injection molding, blow molding.

UNIT II

Micro Mechanical Analysis of a Lamina:

Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli by Rule of mixture, Numerical problems.

Macro Mechanics of a Lamina: Hooke's law for different types of materials, Number of elastic constants, Two - dimensional relationship of compliance and stiffness matrix. Hooke's law for two-dimensional angle lamina, engineering constants - Numerical problems. Stress-Strain relations for lamina of arbitrary orientation, Numerical problems.

UNIT III

Biaxial Strength Theories

Maximum stress theory, Maximum strain theory, Tsai-Hill theory, Tsai, Wu tensor theory, Numerical problems.

Macro Mechanical Analysis of Laminate

Introduction, code, Kirchoff hypothesis, CL T, A, B, and D matrices (Detailed derivation) , Special cases of laminates, Numerical problems.

UNIT IV

Metal Matrix Composites:

Metal Matrix Composites: Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC’s and its application.

Fabrication Process For MMC's: Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.

Study Properties Of MMC's: Physical Mechanical, Wear, machinability and Other Properties. Effect of size, shape and distribution of particulate on properties.

UNIT V

Failure Theories

Micromechanics of Failure of Unidirectional Lamina, Anisotropic Strength and Failure Theories, Importance of Shear Strength, Choice of Failure Criteria, Examples.

Textbooks:

1. K.K. Chawla, Composite Materials, Springer-Verlag, New York, 1998.
2. B.T. Astrom, Manufacturing of Polymer Composites, Chapman & Hall, 1997.
3. Stuart M Lee, J. Ian Gray, Miltz, Reference Book for Composites Technology, CRC press, 1989.

Reference Books:

1. Frank L Matthews and R D Rawlings, Composite Materials: Engineering and Science, Taylor and Francis, 2006.
2. D. Hull and T.W. Clyne, Introduction to Composite Materials, Cambridge University Press, 1996.
3. M.R. Piggott, Load Bearing Fibre Composites, Pergamon press, Oxford, 1998.
4. F. Ashby and D.R.H. Jones, Engineering Materials, Pergamon press, 1999.
5. R.W. Davidge and A. Kelly, Mechanical behavior of ceramics, Cambridge university press, 1999.
6. Andrew C. Marshall, Composite Basics, Marshall Consulting. Mode of Evaluation Quiz/Assignment/ Seminar/Written Examination, 1998.

Online Learning Resources:

- https://nptel.ac.in/courses/112104221
- https://nptel.ac.in/courses/112104229
- https://nptel.ac.in/courses/112104161
- https://onlinecourses.nptel.ac.in/noc22_me40/preview

B. TECH-ME-III-II Sem

23A03605e	INTRODUCTION TO HYBRID AND ELECTRIC VEHICLES (Professional Elective-III)	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	Foundational and applied knowledge of electric vehicle systems, battery technologies, and battery management systems.
2	Understanding of electric vehicle power plants, and drive control techniques essential for efficient electric vehicle propulsion.
3	Knowledge of hybrid and electric vehicle technologies, including their historical evolution and energy efficiency optimization.
4	Provide comprehensive knowledge of electric and hybrid electric vehicle systems, and real-world applications ranging from passenger cars to heavy-duty and fuel cell vehicles.
5	Demonstration of hybrid and electric vehicle design, energy management strategies for efficient and sustainable vehicle operation.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Analyze and design electric vehicle propulsion and energy storage systems, evaluate battery performance and management strategies	*L3,L4,L5*
2	Implement electric machine operation, design and analyze control power electronic converters, and apply drive control strategies in electric vehicle applications.	L3,L4,L6
3	Analyze hybrid and electric drivetrain configurations, evaluate and create various electric motor drives and hybrid vehicle propulsion systems.	L4,L5,L6
4	Compare hybrid and electric vehicle architectures, understand control strategies for various drive systems, and evaluate the role of emerging technologies in improving vehicle efficiency and sustainability.	L1,L2,L5
5	Design and evaluate hybrid and electric vehicle systems, and applying control and communication principles across various electric and hybrid vehicle architectures.	L3,L5,L6

UNIT I:

Electric Vehicle Propulsion and Energy Sources

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

UNIT II:

Electric Vehicle Power Plant And Drives

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives- PWM, current control method. Switch reluctance machine drives - voltage control, current control.

UNIT III:

Hybrid And Electric Drive Trains

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

UNIT IV:

Electric and Hybrid Vehicles - Case Studies

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

UNIT V:

Electric And Hybrid Vehicle Design :

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

Text Books :

1. Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", 2nd edition, CRC Press, 2003.
2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, "Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach", illustrated edition, John Wiley & Sons, 2014.

References:

1. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, Wiley- Blackwell, 2018.
3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press,

2004.

Online Learning Resources:

https://nptel.ac.in/courses/108103009

- https://youtube.com/playlist?list=PL9-f9hWLZS62VF18qPQ1gC7NqIAjaClsl&si=JKUPBH9r1LPqsm9-
- https://youtu.be/h5ysddrlXLw?si=UzfPunK1x-MQOAz1
- https://youtu.be/i7Rq0bN8eig?si=iHGLGNTGOzSTaGpW

B. TECH-ME-III-II Sem

		L	T	P	C
23A03601P	**HEAT TRANSFER LAB**	**0**	**0**	**3**	**1.5**

Course Objectives: Students undergoing this course would	
1	Understand different modes of heat transfer
2	Gain knowledge about natural and force convection phenomenon
3	Estimate experimental uncertainty in measurements

Course Outcomes: Upon the successful completion of course, students will be able to	
1	Explain different modes of heat transfer
2	Identify parameters for measurement for calculating heat transfer
3	Determine effectiveness of heat exchanger
4	Design new equipment related to heat transfer
5	Apply principles of heat transfer in wide application in industries.

List of Experiments:

1. Determine the overall heat transfer coefficient across the width of composite wall
2. Determine the thermal conductivity of a metal rod
3. Determine the thermal conductivity of insulating powder material through concentric sphere apparatus
4. Determine the thermal conductivity of insulating material through lagged pipe apparatus
5. Determine the efficiency of a pin fin in natural and forced convection.
6. Determine the heat transfer coefficient for a vertical cylinder in natural convection
7. Determine the heat transfer coefficient in forced convection of air in a horizontal tube.
8. Determine the heat transfer coefficients on film and drop wise condensation apparatus.
9. Determine the effectiveness of a parallel and counter flow heat exchanger.
10. Study the pool boiling phenomenon and different regimes of pool boiling.
11. Experiment on pool boiling
12. Determine the emissivity of the test plate surface.
13. Experiment on Stefan-Boltzmann apparatus

14. Determine the heat transfer rate coefficient in fluidized bed apparatus.

Virtual Lab:-

1. Determination of thermal conductivity of a metal rod

   https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/determination-of-thermal-conductivity-of-a-metal-rod
2. Natural Convection heat transfer

   https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/natural-convection
3. Heat Transfer by Radiation

   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&cnt=1
4. Heat transfer by Conduction

   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=801&cnt=1
5. The Study of phase change

   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=709&cnt=1
6. Black Body Radiation: Determination of Stefan's Constant

   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=548&cnt=1
7. Newton's Law of Cooling

   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=354&cnt=1
8. Lee's Disc Apparatus

   https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=353&cnt=1
9. Thermo Couple-See beck Effect
10. https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=351&cnt=1

B.Tech (ME)– III-II Sem

23A03602P	CAD/CAM Lab (Professional Core)	L	T	P	C
		0	0	3	1.5

Course objectives: The objectives of the course are to	
1	Develop students' skills in drafting and understanding orthographic, isometric views, and CAD file formats like DXE and IGES.
2	Enable the creation of 3D part models using basic and advanced features in CAD tools.
3	Hands-on experience in assembly modeling using both feature-based and Boolean-based methods.
4	Familiarize with CAM software for generating NC code for various machining processes.
5	Expertise industrial manufacturing via the use of post-processors and NC machines for real-time machining.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Create accurate 2D technical drawings using orthographic and isometric projections, and interpret file formats like DXE and IGES.	*L1,L2,L3*
2	Develop 3D part models using features such as protrude, revolve, shell, and sweep, and demonstrate and evaluate parent-child relationships.	*L2,L3,L5*
3	Construct and analyze assemblies using feature-based and Boolean operations for simple mechanical systems and create complex mechanical assemblies.	*L3,L4,L6*
4	Generate NC code for complex surfaces using CAM tools and study the function of various post-processors.	*L1,L3,L6*
5	Transfer NC code to CNC machines. Perform and evaluate basic machining tasks such as turning and milling and generate new technics by using modern tools.	*L4,L5,L6*

List of Experiments:

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE AND IGES FILES.
2. **Part Modelling:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation.
3. **Assembly modelling:** Feature based and Boolean based modelling surfaces, Assembly Modelling of simple components and Design of simple components.
4. CAM**:**
   a) Study of various post processors used in NC Machines.
   b) Development of NC code for free form and sculptured surfaces using CAM packages.
   c) Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM packages.

   Through Any Four Software Packages from the following: Use of Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, , CAEFEM, Gibbs CAM, Master CAM etc,.
5. Evaluation of Stress/Strain for a plate with a hole.

B. TECH-ME-III-II Sem

23A03607	3 D PRINTING LAB	L	T	P	C
		0	1	2	3

Course Objectives: Students undergoing this course would	
1	Understand different methods of 3D Printing.
2	Gain knowledge about simulation of FDM process
3	Estimate time and material required for manufacturing a 3D component

Course Outcomes: Upon the successful completion of course, students will be able to	
1	Explain different types of 3d Printing techniques
2	Identify parameters for powder binding and jetting process
3	Determine effective use of ABS material for 3D Printing
4	Apply principles of mathematics to evaluate the volume of material require.

Module 1:

Introduction to Prototyping, Working of 3D Printer, Types of 3D printing Machines:

Exp 1: Modelling of Engineering component and conversion of STL format.

Exp 2: Slicing of STL file and study of effect of process parameter like layer thickness, orientation, and infill on build time using software.

Exercise 1 : Component-1

Exercise 2 : Component-2

Module 2:

Exp 1 : 3D Printing of modelled component by varying layer thickness.

Exp 2 : 3D Printing of modelled component by varying orientation.

Exp 3: 3D Printing of modelled component by varying infill.

Module 3:

Study on effect of different materials like ABS, PLA, Resin etc, and dimensional accuracy.

Module 4:

Identifying the defects in 3D Printed components.

Module 5

Exp1: Modelling of component using 3D Scanner of real life object of unknown dimension in reverse engineering**.**

Exp 2: 3D Printing of above modelled component.

References:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e, World Scientific Publishers, 2003.

Online Learning Resources/Virtual Labs:

- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
  https://www.youtube.com/watch?v=NkC8TNts4B4

B. TECH-ME-III-II Sem

23A03601	TECHNICAL REPORT WRITING & IPR	L	T	P	C
		2	0	0	0

Course Objectives:·

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

ırse Outcomes: On successful completion of this course, the students will be able to:

COURSE OUTCOMES: At the end of the course, students will be able to		**Blooms Level**
CO1	Identify key secondary literature related to their proposed technical paper writing	L1, L2
CO2	Explain various principles and styles in technical writing	L1, L2
CO3	Use the acquired knowledge in writing a research/technical paper	L3
CO4	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.	L4
CO5	Evaluate different forms of IPR available at national & international level	L5
CO6	Develop skill of making search of various forms of IPR by using modern tools and techniques.	L3, L6

IT – I:

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence andlogical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing .

IT – II:

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problems and

Framing Research Questions- Synopsis

UNIT – III:

Process of research: publication mechanism: types of journals- indexing-seminars-

conferences- proof reading –plagiarism style; seminar & conference paper writing;

Methodology-discussion-results- citation rules

UNIT – IV:

oduction to Intellectual property: Introduction, types of intellectual property, International organizations, age ties, importance of intellectual property rights

de Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, sele uating trade mark, trade mark registration processes.

UNIT – V:

of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to orm the work publicly, copy right ownership issues, copy right registration, notice of copy right, international y right law

of patents: Foundation of patent law, patent searching process, ownership rights and transfer.Patent law, llectual property audits.

tbooks:

1. Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. *Technical Communication:Principles and practices.*Oxford.

erence Books:

1. R.Myneni, *Law of Intellectual Property*, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli,*Intellectual Property Rights* Tata Mcgraw Hill, 2001
3. P.Naryan,*Intellectual Property Law*, 3rd Ed ,Eastern Law House, 2007.
4. Adrian Wallwork. *English for Writing Research Papers*Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, *Technical Writing Style*

Online Resources

1. **https://theconceptwriters.com.pk/principles-of-technical-writing/**
2. **https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html**
3. **https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html**
4. **https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/**
5. **https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf**
6. **https://lawbhoomi.com/intellectual-property-rights-notes/**
7. **https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf**

B. TECH-ME-IV-I Sem

		L	T	P	C
23A03701	**AI & ML FOR MECHANICAL ENGINEERING**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Knowledge of Artificial Intelligence, focusing on intelligent agents, problem-solving techniques, and state-space search approaches.
2	Understand and apply various problem-solving and search techniques, including uniform and heuristic search strategies in artificial intelligence.
3	Explore and apply local search techniques for solving Constraint Satisfaction Problems (CSPs) and adversarial search strategies to make optimal decisions.
4	Apply various statistical reasoning techniques for knowledge representation and reasoning in AI, as well as logic programming and reasoning methods.
5	Familiar in fundamental concepts of Machine Learning techniques, as well as classification, regression, clustering problems, and an introduction to neural networks and deep learning.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Design intelligent agents, define problems using state-space models, and apply AI techniques.	*L1,L3,L6*
2	Implement and compare different search algorithms (both uniform and heuristic), apply and analyze appropriate strategies for solving AI problems.	L3,L4,L5
3	Solve CSPs using local search methods and implement adversarial search algorithms to make optimal decisions in competitive game scenarios.	L2,L5,L6
4	Utilize statistical and logical reasoning methods, to represent knowledge and perform forward and backward reasoning in AI applications.	L1,L2,L3
5	Understanding and apply various machine learning techniques, along with an introduction to neural networks and deep learning.	L1,L2,L3

UNIT I

Introduction to Artificial Intelligence and Problem-Solving Agent: Problems of AI, AI technique, Tic – Tac – Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem as state space search, production system, problem characteristics, and issues in the design of search programs.

UNIT II

Search Techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best -first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search.

UNIT III

Constraint Satisfaction Problems and Game Theory: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

UNIT IV

Knowledge & Reasoning: Statistical Reasoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge representation, procedural and declarative knowledge, Logic programming, Forward and backward reasoning.

UNIT V

Introduction to Machine Learning: Exploring sub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforcement learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and deep learning.

Text Books

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2015.
2. Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", 1st Edition, Morgan-Kaufmann, 1998.

Reference Books

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, "Artificial Intelligence", McGraw Hill, 3rd ed.,2017.
2. Patterson, "Introduction to Artificial Intelligence & Expert Systems", Pearson, 1st ed. 2015.
3. Saroj Kaushik, "Logic & Prolog Programming", New Age International, Ist edition, 2002.
4. Joseph C. Giarratano,Gary D. Riley, "Expert Systems: Principles and Programming", 4th Edition, 2007.

Online Learning Resources:

https://nptel.ac.in/courses/113104517

https://nptel.ac.in/courses/127104664

https://nptel.ac.in/courses/110104164

https://nptel.ac.in/courses/106106226

IV B.Tech I Semester

23A52701a	Management Course- II BUSINESS ETHICS AND CORPORATE GOVERNANCE	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES : The objectives of this course are

1 To make the student understand the principles of business ethics
2 To enable them in knowing about the ethics in management
3 To facilitate the student' role in corporate culture
4 To impart knowledge about the fair-trade practices
5 To encourage the student in knowing about the corporate governance

Syllabus

UNIT-I: Ethics

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior.. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management - Corporate Social Responsibility – Issues of Management – Crisis Management.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Analyze issues & crisis of management

UNIT-II: ETHICS IN MANAGEMENT

Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the meaning of Ethics in various areas of management
- Compare and contrast professional ethics and technical ethics
- Develop ethical values in self and organization

UNIT-III : CORPORATE CULTURE

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

LEARNING OUTCOMES:- After completion of this unit student will

- Define corporate culture
- Understand the key elements of corporate culture

- Analyze organization leadership and corporate culture

UNIT- IV: LEGAL FRAME WORK

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand Law and Ethics
- Analyze Different fair trade practices
- Make use of Environmental Protection and Fair Trade Practices

UNIT -V: CORPORATE GOVERNANCE

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitations.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand corporate governance code
- Analyze role of auditors, board of directors and shareholders in corporate governance
- Implementing corporate social responsibility in India.

Text books.

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH. June 2010

Reference books

1. Dr. K. Nirmala, KarunakaraReaddy. *Business Ethics and Corporate Governance*, HPH
2. H.R.Machiraju: *Corporate Governance*, HPH, 2013
3. K. Venkataramana, *Corporate Governance*, SHBP.
4. N.M.Khandelwal. *Indian Ethos and Values for Managers*

COURSE OUTCOMES: At the end of the course, students will be able to

		BTL
CO1	Understand the Ethics and different types of Ethics.	L2
CO2	Understand business ethics and ethical practices in management	L2
CO3	Understand the role of ethics in management	L2
CO4	Apply the knowledge of professional ethics & technical ethics	L3
CO5	Analyze corporate law, ethics, codes & principles	L4
CO6	Evaluate corporate governance & corporate scams	L5

BTL = Bloom’s Taxonomy Level

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. https://archive.nptel.ac.in/courses/110/105/110105138/
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/
5. https://archive.nptel.ac.in/courses/109/106/109106117/

<table>
<tr><td rowspan="2">23A52701b</td><td rowspan="2">E-Business
(Elective-2 VII - SEMESTER)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td></tr>
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Course Objectives: The Objectives of this course are

1. To provide knowledge on emerging concept on E-Business related aspect.
2. To understand various electronic markets & business models.
3. To impart the information about electronic payment systems & banking.
4. To create awareness on security risks and challenges in E-commerce.
5. To the students aware on different e-marketing channels & strategies.

Unit-I: Electronic Business

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Learning Outcomes: -After completion of this unit student

- Understand the concept of E-Business
- Contrast and compare E-Commerce & E-Business
- Evaluate opportunities of E-commerce for industry

Unit-II: Electronic Markets and Business Models

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India

Learning Outcomes: -After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze the B2B,B2C and B2G model

Unit-III: Electronic Payment Systems:

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments

Learning Outcomes: -After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and smart cards
- Analyze debit card and credit cards

Unit-IV:E-Security

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) - Firewalls in securing e-business platforms.

Learning Outcomes: -After completion of this unit student will

- ➢ Understand E-Security
- ➢ Contrast and compare security protocols and public network
- ➢ Evaluate on Digital signature

Unit-V:E-Marketing:

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research– – E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

Learning Outcomes: -After completion of this unit student will

- ➢ Understand the concept of online marketing
- ➢ Apply the knowledge of online marketing
- ➢ Compare e-CRM and e-SCM

<u>Text Books:</u>

1. Arati Oturkar&Sunil Khilari. *E-Business*. Everest Publishing House, 2022
2. P.T.S Joseph. *E-Commerce*, Fourth Edition, Prentice Hall of India, 2011

<u>References:</u>

1. Debjani, Kamalesh K Bajaj. *E-Commerce*, Second Edition Tata McGraw-Hill’s, 2005
2. Dave Chaffey.*E-Commerce E-Management,* Second Edition, Pearson, 2012.
3. Henry Chan. *E-Commerce Fundamentals and Application,* RaymondLeathamWiley India 2007
4. S. Jaiswal. *E-Commerce* GalgotiaPublication Pvt Ltd., 2003.

COURSE OUTCOMES: At the end of the course student will be able to		**BTL**
CO1	Remember E-Business & its nature, scope and functions.	L1
CO2	Understand E-market-Models which are practicing by the organizations	L2
CO3	Apply the concepts of E-Commerce in the present globalized world.	L3
CO4	Analyze the various E-payment systems & importance of net banking.	L4
CO5	Evaluate market research strategies & E-advertisements.	L5
CO6	Understand importance of E-security & control	L2

BTL = Bloom's Taxonomy Level

Online Resources:

https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771

https://www.slideshare.net/VikramNani/e-commerce-business-models

https://www.slideshare.net/RiteshGoyal/electronic-payment-system

https://www.slideshare.net/WelingkarDLP/electronic-security

https://www.slideshare.net/Ankitha2404/emarketing-ppt

23A52701c	Management Science	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES : The objectives of this course are

1. To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2. To make the students understand the role of management in Production
3. To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
4. To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
5. To make the students aware of the contemporary issues in modern management

UNIT- IINTRODUCTION TO MANAGEMENT

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand the concept of management and organization
- Apply the concepts & principles of management in real life industry.
- Analyze the organization chart & structure of an enterprise.

UNIT - II OPERATIONS MANAGEMENT

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- **Material Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand the core concepts of Operations Management
- Apply the knowledge of Quality Control, Work-study principles in real life industry.
- Evaluate Materials departments & Determine EOQ
- Analyze Marketing Mix Strategies for an enterprise.
- Create and design advertising and sales promotion

UNIT - III HUMAN RESOURCES MANAGEMENT (HRM)

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process - Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

LEARNING OUTCOMES: At the end if the Unit, the students will be able to

- Understand the concepts of HRM, Recruitment, Selection, Training & Development
- Analyze the need of training
- Evaluate performance appraisal
- Design the basic structure of salaries and wages

UNIT - IV STRATEGIC & PROJECT MANAGEMENT

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation
- Evaluate PERT and CPM Techniques

UNIT - V CONTEMPORARY ISSUES IN MANAGEMENT

Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re-engineering and Bench Marking - Knowledge Management – change management –sustainability and corporate social responsibility.

LEARNING OUTCOMES At the end if the Unit, the students will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in TQM, SCM
- Analyze CRM, BPR
- Evaluate change management & sustainability

Text Books:

1. Frederick S. Hillier, Mark S. Hillier. *Introduction to Management Science*, October 26, 2023
2. A.R Aryasri, *Management Science*, TMH, 2019

References:

1. Stoner, Freeman, Gilbert.*Management*, Pearson Education, New Delhi, 2019.
2. Koontz & Weihrich, *Essentials of Management*, 6/e, TMH, 2005.
3. Thomas N.Duening & John M.Ivancevich, *Management Principles and Guidelines*, Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Samuel C.Certo, *Modern Management*, 9/e, PHI, 2005

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Remember the concepts & principles of management and designs of organization in a practical world	**L1**
CO2	Understand the knowledge of Work-study principles & Quality Control techniques in industry	**L2**
CO3	Apply the process of Recruitment & Selection in organization.	**L3**
CO4	Analyze the concepts of HRM & different training methods.	**L4**
CO5	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.	**L5**
CO6	Create awareness on contemporary issues in modern management & technology.	**L3**

BTL = Blooms Taxonomy Level

ONLINE RESOUECES:

1. https://www.slideshare.net/slideshow/introduction-to-management-and-organization-231308043/231308043
2. https://nptel.ac.in/courses/112107238
3. https://archive.nptel.ac.in/courses/110/104/110104068/
4. https://archive.nptel.ac.in/courses/110/105/110105069/
5. https://onlinecourses.nptel.ac.in/noc24_mg112/

B.Tech (ME)– IV-I Sem

23A03702a	MECHANICAL VIBRATIONS (Professional Elective-IV)	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	Introduce fundamental concepts of vibration analysis, focusing on Single Degree Freedom (SDOF) systems and their solutions.
2	Develop understanding of forced vibration, resonance, and damping effects in Single Degree Freedom systems, including vibration isolation.
3	Explore the dynamics of Two Degree Freedom (2DOF) systems and their application in vibration absorbers and coupled systems.
4	Familiarize Multi Degree Freedom (MDOF) systems, methods for formulating equations of motion, and vibration analysis techniques
5	Explain vibration measurement tools, transducers, and exciters used in experimental vibration analysis.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Define, Understand and Solve problems related to undamped and damped free vibrations in Single Degree Freedom systems using classical and energy methods.	*L1,L2.L3*
2	Analyze forced vibrations in Single Degree Freedom systems under various excitation forces, apply and evaluate the concepts of transmissibility and isolation.	*L3,L4,L5*
3	Derive the equations of motion, calculate natural frequencies, modes of vibration, and understand their application in dynamic vibration absorbers.	*L2,L3,L5*
4	Formulate equations of motion, and perform modal analysis of free and forced vibrations. Apply vibration measurement tools to select appropriate exciters for vibration testing.	*L4,L5,L6*
5	Explain and evaluate the damping characteristics in vibrating systems, including the effects of viscous damping, Coulomb damping, and damping in whirling of shafts.	*L2,L5,L6*

UNIT I

Single Degree Freedom Systems

Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient. Simple problems.

Whirling of shafts: Transverse vibrations: Dunkerley's lower bound approximation, Critical speed of shafts.

UNIT II

Forced vibrations of Single Degree Freedom Systems

Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping.

UNIT III

Two Degree Freedom Systems:

Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

UNIT IV

Multi Degree Freedom Systems:

Lagrangian method for formulation of equation of motion Influence co- efficient method, Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of free and forced vibrations.

UNIT V

Vibration measurement and Applications

Transducers: variable resistance transducers, Piezoelectric transducers, electro dynamic transducers and linear variable differential transformer transducer; Vibration pickups: vibrometer, accelerometer, velometer and phase distortion; Frequency-measuring instruments; Vibration exciters- Mechanical exciters and electro dynamic shaker.

Textbooks:

1. Singiresu S. Rao, Mechanical Vibrations, 6/e, Pearson Education, 2018.
2. G.K.Groover, Mechanical Vibrations, Nemchand& Bro, 8/e, 2009.

Reference Books:

1. L. Meirovich, Elements of Vibrations Analysis, Tata McGraw Hill, 1986.
2. S. Graham Kelly, Mechanical Vibrations, Tata McGraw Hill, 1996
3. William Thomson, Theory of Vibrations with Applications, 5/e, Pearson, 2008
4. William Weaver, Timeoshenko, and Young, Vibration Problems in Engineering, 5/e, John Wiley, 2013.
5. C. Nataraj, Vibration of Mechanical Systems, 1/e, Cenage Learning, 2012.

Online Learning Resources:

- https://nptel.ac.in/courses/112107212
- https://nptel.ac.in/courses/112103111
- https://nptel.ac.in/courses/112103112
- https://nptel.ac.in/courses/101105081
- https://www.iare.ac.in/sites/default/files/PPT/MVSD%20PPT.pdf
- https://www.iare.ac.in/sites/default/files/lecture_notes/MV_LECTURE_NOTES.pdf

B.Tech (ME)– IV-I Sem

23A03702b	**FINITE ELEMENT METHODS** **(Professional Elective-I)**	L	T	P	C
		3	0	0	3

	Course Objectives: The objectives of this course is to
1	Learn basic principles of finite element analysis procedure.
2	Gain knowledge of the concepts of Nodes and elements
3	Know the theory and characteristics of finite elements that represent engineering structures.
4	Apply finite element solutions to structural, thermal, and dynamic problems.
5	Develop the knowledge and skills to evaluate finite element analyses and apply design analysis Effectively.

COURSE OUTCOMES On successful completion of this course the students will be able to		
CO1	*Understand the concepts behind formulation methods in FEA*	L2, L3,L6
CO2	*Explain the concepts of Nodes and elements used in the analysis of beams and solve the simple problems*	L2, L4,L6
CO3	Understand the 2D stress analyses of the FEM method and solve the strain triangles.	L2,L4,L6
CO4	Apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.	L1, L3,L5
CO5	Identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer and fluid flow.	L1, L3,L5

UNIT I
Introduction to finite element methods
Introduction to finite element methods for solving field problems, applications, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, Rayleigh-Ritz method, Formulation of Finite Element Equations.
One dimensional Problems: Finite element modelling of ID bar elements coordinates and shape functions. Requirements for Convergence and Interpolation functions, Pascal’s Triangle, Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT II
1D Analysis of Trusses and Beams
Analysis of trusses: Stiffness Matrix for 1D truss element, Stress Calculations and Problems with maximum of three elements.
Analysis of beams: Element Stiffness Matrix and Load vector for 1 D beam element, Hermite shape functions and simple problems.

UNIT III
2D Analysis
Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses.
Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

UNIT IV
Quadrilateral Elements & Thermal Analysis
Quadrilateral Elements: Isoparametric, Sub parametric and Super parametric elements, Modelling of 4 noded and 8 noded quadrilateral elements and simple problems. Numerical Integration.
Steady state heat transfer analysis: One dimensional analysis of composite slab and fin.

UNITV

Dynamic analysis

Analysis of a 1D uniform shaft subjected to torsion – Simple problems

Dynamic analysis: Formulation of finite element model, element – mass matrices, evaluation of Eigen values and Eigen vectors for a bar and shaft.

Textbooks:

1. T. Chandraputla, Ashok Belegundu, Introduction to Finite Element in Engineering, Pearson Publication 2011.
2. S.S.Rao, The Finite Element Methods in Engineering, Elsevier Butterworth -Heinemann, 2/e, 2011.
3. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993.

Reference Books:

1. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3/e, John Wiley, New York, 1989.
2. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, 1982.
3. G.LakshmiNarasaiah, Finite Element Analysis, 1/e, B.S. Publications, 2008.
4. O C Zienkiewicz and R L Taylor, the Finite Element Method, 3/e. McGraw-Hill, 1989.

Online Learning Resources:

https://nptel.ac.in/courses/112/104/112104193/
https://nptel.ac.in/courses/112/104/112104205/
https://nptel.ac.in/courses/105/105/105105041/
https://nptel.ac.in/courses/112/106/112106130/
https://nptel.ac.in/courses/112/103/112103295/

B.Tech (ME)– IV-I Sem

23A03702c	REFRIGERATION & AIR CONDITIONING (Professional Elective-IV)	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	Present the fundamental concepts and laws of refrigeration systems including Carnot and air-based cycles.
2	Explain the working principles, components, and performance parameters of vapour compression refrigeration systems.
3	Knowledge of alternative refrigeration systems such as vapour absorption, steam jet, thermoelectric, and vortex refrigeration.
4	Understanding of psychrometric processes and air conditioning load calculations.
5	Familiarize with air conditioning components and the concept of human thermal comfort and heat pumps.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Define and explain the principles of refrigeration and analyze the performance of air refrigeration systems including aircraft applications.	L1,L2,L4
2	Apply thermodynamic principles to analyze and solve problems related to vapour compression refrigeration cycles using P-h and T-S diagrams.	L3,L4,L5
3	Describe the operation of various refrigeration systems, calculate theoretical COP and create the effective refrigeration system .	L2, L3,L6
4	Knowledge on psychometric chat and evaluate air conditioning processes using psychometric charts and analyze various cooling systems for different climates.	L1,L4,L5
5	Identify and select appropriate air conditioning equipment based on comfort requirements and system needs. Build an effective air conditioning system.	L2,L4,L6

UNIT I

Introduction to Refrigeration

Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods.

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems **-** Numerical Problems **-** Refrigeration Needs of Air Crafts.

UNIT II

Vapour Compression Refrigeration (VCR) System

Vapour Compression Refrigeration (VCR) System - Basic Cycle - Working Principle and Essential Components of the Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Actual Cycle- Influence of Various Parameters on System Performance - Construction and Use of P-h Charts - Numerical Problems. Refrigerants - Desirable Properties - Classification of Refrigerants Used - Nomenclature- Secondary Refrigerants- Lubricants - Ozone Depletion - Global Warming- Newer Refrigerants.

UNIT III

Vapor Absorption Refrigeration (VAR) System

Vapor Absorption Refrigeration (VAR) System-Description and Working of NH_3 - Water System and Li Br -Water (Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System

STEAM JET REFRIGERATION SYSTEM: Working Principle and Basic Components-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (ii) Vortex Tube or Hilsch Tube.

UNIT IV

Introduction to Air Conditioning:

Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads - Need For Ventilation, Consideration of Infiltrated Air - Heat Load Concepts. Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

UNIT V

Air Conditioning Equipment

Air Conditioning Equipment - Humidifiers - Dehumidifiers - Air Filters, Fans and Blowers.

Human Comfort**:** Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart. Heat Pump - Heat Sources - Different Heat Pump Circuits. Energy efficient AC system Star Rating.

Textbooks:

1. Refrigeration and Air Conditioning, C P Arora, TMH, 15/e, 2013.
2. S. C Arora & Domkundwar, A Course in Refrigeration and Air conditioning, Dhanpat rai & Co, 2018.

Reference Books:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2/e, 2013
2. Principles of Refrigeration - Dossat / Pearson Education, 4/e, 2007
3. Refrigeration and Air Conditioning-P.L.Ballaney, 2/e, 2012.
4. Basic Refrigeration and Air-Conditioning - P.N.Ananthanarayanan / TMH, 4/e, 2013.

NOTE: Tables/Codes: Thermal Engineering Data Book containing refrigerant and Psychrometric property Tables and charts are permitted in Exam.

Online Learning Resources:

- https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_RAC_Lecture_Notes.pdf
- https://www.studocu.com/en-us/document/saint-louis-university/fluid-dynamics-laboratory/refrigeration-lecture-notes-1/3020577
- http://home.iitk.ac.in/~samkhan/ME340A.htm
- https://nptel.ac.in/courses/112105129
- http://dte.karnataka.gov.in/Institutes/gptkampli/GenericDocHandler/68-fc177b7d-f5d1-4580-b577-b1118df994f4.pdf

B.Tech (ME)– IV-I Sem

23A03702d	MECHATRONICS AND MEMS (Professional Elective-IV)	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	**To introduce** the concept of mechatronics and its significance in modern industrial applications.
2	**To explain** the working principles, characteristics, and selection of various types of sensors.
3	**To describe** different actuator systems and their integration in automation circuits.
4	**To develop** understanding of microprocessors, microcontrollers, and PLCs including programming and control logic.
5	**To explore** MEMS technologies, fabrication techniques, and their applications in miniaturized systems.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Define and explain the fundamental concepts and applications of mechatronics in industrial systems.	L1,L2, L3
2	Identify and analyze various types of sensors and their performance characteristics for specific applications.	L2,L4,L5
3	Design and evaluate actuator systems including hydraulic and pneumatic circuits for automation tasks.	L3,L5,L6
4	Understand and develop PLC ladder logic programs for industrial automation using sequencing, timers, counters, and analog I/O.	L2,L3,L6
5	Describe MEMS fabrication methods, apply and analyze the effect of scaling in micro electromechanical systems.	L2,L3,L4

UNIT I
Introduction
Definition of Mechatronics, Need for Mechatronics in Industry, Objectives of mechatronics, mechatronics design process, Mechatronics key elements, mechatronics applications – Computer numerical control (CNC) machines, Tool monitoring systems, Flexible manufacturing system (FMS), Industrial Robots, Automatic packaging systems, Automatic inspection systems.

UNIT II
Sensors
Static and dynamic characteristics of sensors, Displacement, Position and Proximity sensors, Force and torque sensors, Pressure sensors, Flow sensors, Temperature sensors, Acceleration sensors, Level sensors, Light sensors, Smart material sensors, Micro and Nano sensors, Selection criteria for sensors.

UNIT III
Actuators
Mechanical, Electrical, Hydraulic and Pneumatic Actuation systems, Characteristics and their limitations, Design of Hydraulic and Pneumatic circuits, Piezoelectric actuators, Shape memory alloys, Selection criteria for actuators.

UNIT IV
Microprocessors, Microcontrollers and Programmable Logic Controllers
Architecture of Microprocessor, Microcontroller and Programmable Logic Controller, PLC Programming using ladder diagrams, logics, latching, sequencing, timers relays and counters, data handling, Analog input/output, selection of controllers.

UNIT V
Micro Electro Mechanical Systems (MEMS)
History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, Applications: Lab on chip.

Textbooks:

1. Bolton, Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering, 3/e, Pearson Education Press, 2005.
2. Devadas Shetty and Richard A Kolk, Mechatronic System Design, 2/e, Cengage learning, 2010.
3. N. Mahalik, MEMS, McGraw Hill Educations, 2017.

Reference Books:

1. Clarence W. de Silva, Mechatronics an Integrated Approach, CRC Press, 2004.
2. James J Allen, Micro Electro Mechanical Systems Design, CRC Press Taylor & Francis group, 2005.
3. Ganesh S Hedge, Mechatronics, Jones & Bartlett Learning, 2010.
4. Mohammed Gad, MEMS; Design and Fabrication, CRC Press, 2010.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc22_me54/preview
- https://nptel.ac.in/courses/112108092
- https://nptel.ac.in/courses/112101304
- https://onlinecourses.nptel.ac.in/noc20_ee56/preview
- https://www.cet.edu.in/noticefiles/259_Lecturer%20Note%20on%20Mechatronics-ilovepdf-compressed.pdf, https://lecturenotes.in/subject/1176/mechatronics-and-mems

B.Tech (ME)– IV-I Sem

		L	T	P	C
23A03702e	**POWER PLANT ENGINEERING (Professional Elective-IV).**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Familiarize the sources of energy, power plant economics and environmental aspects.
2	Outline the working components of different power plant.
3	Understand the working mechanism of diesel and gas turbine power plants.
4	Impart types of nuclear power plants, and outline working principle and advantages and hazards.
5	Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Outline sources of energy, power plant economics, and environmental aspects.	L2
2	Describe working components of a steam power plant.	L2
3	Illustrate the working mechanism of diesel and gas turbine power plants.	L2,
4	Summarize types of renewable energy sources and their working principle.	L2
5	Demonstrate the working principle of nuclear power plants.	L4

UNIT I

Introduction to the Sources Of Energy - Resources and Development of Power in India. Convectional and non- conventional energy sources, Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection And Safety Regulations.

UNIT II

Steam Power Plant : Introduction to Boilers- Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : Properties of Coal - Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2 Recorders

UNIT III

Diesel Power Plant: Diesel Power Plant, Construction, Plant lay out with auxiliaries, fuel storage.
GAS TURBINE PLANT: Introduction - Classification - Construction - Layout with Auxiliaries - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT IV

Hydro Electric Power Plant: Water Power - Hydrological Cycle / Flow Measurement - Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways.
Hydro Projects Plant: Types - Typical Layouts - Plant Auxiliaries - Plant Operation Pumped Storage Plants.

UNIT V

Power from Non-Conventional Sources: Utilization of Solar Collectors- Working Principle, Wind Energy - Types of Turbines - HAWT & VAWT-Tidal Energy. MHD power Generation.
Nuclear Power Station: Nuclear Fuel - Nuclear Fission, Chain Reaction, Breeding and Fertile Materials - Nuclear Reactor -Reactor Operation.

Types of Reactors: Pressurized Water Reactor, Boiling Water Reactor, Sodium-Graphite Reactor, Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

TEXT BOOKS:

1. P.K. Nag, “Power Plant Engineering”, 3rd edition, TMH, 2013.
2. Wakil, “Power plant technology”, M.M.EI TMH Publications.

REFERENCE BOOKS:

1. Rajput, “A Text Book of Power Plant Engineering:, 4th edition, Laxmi Publications, 2012.
2. Ramalingam, “Power plant Engineering”, Scietech Publishers, 2013
3. P.C. Sharma, “Power Plant Engineering”, S.K. Kataria Publications, 2012.
4. Arora and S.Domakundwar, “A course in Power Plant Engineering”, Dhanpat Rai & Co (p) Ltd, 2014.

Online Learning Resources:

https://nptel.ac.in/courses/112107291

https://youtube.com/playlist?list=PLLy_2iUCG87BT8H9uMufjrcPF5e6Qd2bz&si=RQhZwEibgqXK2dRL

https://youtube.com/playlist?list=PLLy_2iUCG87BT8H9uMufjrcPF5e6Qd2bz&si=LjgzdabT7tIsCwJC

https://youtu.be/IdPTuwKEfmA?si=PyF04z9beiVGkXAS

B.Tech (ME)– IV-I Sem

23A03703a	NON CONVENTIONAL ENERGY SOURCES (Professional Elective-V)	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	**To introduce** the principles of solar radiation and its measurement for energy applications.
2	**To explain** the types and working principles of solar energy collectors and storage systems.
3	**To provide** an understanding of various renewable energy sources including wind, biomass, and geothermal energy.
4	**To explore** ocean energy technologies and direct energy conversion systems like thermoelectric generators and fuel cells.
5	**To assess** the economic and environmental impacts of renewable energy systems and their integration into energy infrastructure.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Define and explain the fundamentals of solar radiation and analyze data using appropriate instruments and models.	L1,L2,L4
2	Compare different types of solar collectors and evaluate their thermal performance for various applications.	L3,L4,L5
3	Describe and apply renewable energy technologies such as solar heating, wind turbines, and biomass digesters to evaluate the renewable energy.	L2,L3, L5
4	Illustrate the principles and potential of ocean, geothermal, and mini-hydel energy to apply and create sustainable energy models.	L2,L3,L6
5	Analyze the principles and performance of direct energy conversion systems including fuel cells and MHD generators.	L1,L4,L5

UNIT – I

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT-II

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT-III

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria

UNIT-IV

BIO-MASS: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C.Engine operation and economic aspects.

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

UNIT-V

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidaland wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, and principles of DEC. Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principles, faraday's law's, thermodynamic aspects, selection of fuels and operating conditions.

TEXT BOOKS:

1. Non-Conventional Energy Sources /G.D. Rai Khanna Publisher (
2. Energy Resources Utilization and Technologies, Anjaneyulu Yerramilli, Francis Tuluri, BS Publications, 2012

REFERENCES :

1. Renewable Energy Sources/ Twidell & Weir 3rd edition Routledge publisher (2015)
2. Non Conventional Energy Resources, B.H.Khan, McGrawHIll, 2015
3. Solar Power Engineering/B.S.Magal Frank Kreith & J.F.Kreith.
4. Principles of Solar Energy/ Frank Krieth & John F Kreider.
5. Non-Conventional Energy/ Ashok V Desai/ Wiley Eastern

Online Learning Resources:

https://youtube.com/playlist?list=PL3QMEfkolRFbGhXveCE7RFDBgY0_gRxkh&si=ZYwAnUNtmIwsIq

https://youtube.com/playlist?list=PLfxYQ3zfSrafm79OhjA7hvdCgm29EKrcq&si=wBQZsw0JtePVc2f-

https://youtube.com/playlist?list=PLcWcvGXrBFeRV7f9oyuuX9RabYUuanGrK&si=TVHlSydk9cPw5MsV

B.Tech (ME)– IV-I Sem

23A03606	**AUTOMATION AND ROBOTICS (Professional Elective-V).**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	To introduce the fundamentals of industrial automation, its types, components, and strategies across manufacturing systems.
2	To explain the working of automated flow lines and the methods used in assembly line balancing and flexible automation.
3	To impart knowledge about industrial robots, their configurations, anatomy, and applications in manufacturing processes.
4	To develop an understanding of manipulator kinematics, homogeneous transformations, actuators, and sensors used in robotics.
5	To analyze manipulator dynamics and apply trajectory planning techniques for robotic motion and obstacle avoidance.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Explain the need, types, and elements of automation systems and analyze different levels of automation strategies in industry.	L1,L2,L4
2	Demonstrate the operation of automated flow lines and apply methods for assembly line balancing and optimization.	L2,L3,L4
3	Identify robotic components and describe their configuration, degrees of freedom, and industrial applications in various processes.	L1,L2,L3
4	Apply transformation techniques and D-H notation to solve problems in robot kinematics and evaluate actuator and sensor selection.	L2,L3,L5
5	Analyze robot dynamics using Jacobians and Euler formulations and develop suitable trajectories for obstacle-free motion.	L3,L5,L6

UNIT-I

Introduction to Automation:

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT –II

Automated flow lines:

Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT- III

Introduction to Industrial Robotics:

Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

UNIT- IV

Manipulator Kinematics:

Manipulator Kinematics, Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

UNIT- V

Robot Programming:

Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1. Automation , Production systems and CIM,M.P. Groover /4thEdition, Pearson education (2016)
2. Industrial Robotics - M.P. Groover, TMH (1996)

References:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering , Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006
5. Robotics and Control , Mittal R K &Nagrath I J , TMH.

Online Learning Resources:

Web References:

- http://www.cadcamfunda.com/cam_computer_aided_manufacturing
- http://wings.buffalo.edu/eng/mae/courses/460-564/Course-Notes/cnc- classnotes.pdf
- http://nptel.iitm.ac.in/courses.php?branch=Mechanical
- http://academicearth.org/courses/introduction-to-roboticsVideo references:-http://nptel.iitm.ac.in/video.php?courseId=1052

B.Tech (ME)– IV-I Sem

23A03703b	**NON-DESTRUCTIVE TESTING (Professional Elective-V)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	To introduce the principles, types, and safety aspects of various non-destructive testing (NDT) techniques including radiographic and ultrasonic methods.
2	To explain the theory, equipment, and evaluation procedures for ultrasonic, liquid penetrant, eddy current, and magnetic particle tests.
3	To familiarize students with advanced thermal and infrared inspection techniques and their applications.
4	To examine the use of specialized materials, sensors, and methods in thermal and IR-based NDT techniques.
5	To explore the wide-ranging industrial applications of NDT in fields such as aerospace, automotive, railways, and pressure vessel inspection.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Demonstrate the working principles, equipment, and safety considerations in radiographic and ultrasonic NDT methods and apply and analyze the different methods.	L2,L3,L4
2	Apply appropriate NDT techniques such as liquid penetrant, eddy current, and magnetic particle testing to analyze defect detection to solve the problems.	L3,L4,L5
3	Analyze the effectiveness and limitations of various NDT methods in real-world testing scenarios and create the solutions.	L1,L4,L6
4	Evaluate and create thermal and infrared NDT methods for different materials and structural applications, especially in aerospace and electronics.	L2, L5,L6
5	Illustrate the application of NDT techniques in diverse industrial domains and recommend suitable testing methods for specific components.	L2, L3, L5

UNIT - I

Introduction to non-destructive testing: Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

UNIT - II

Ultrasonic test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect , Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing.

UNIT – III

Liquid penetrant, Eddy Current & Magnetic Particle Test

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.
Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing.

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

UNIT - IV

Infrared & Thermal Testing

Infrared And Thermal Testing: Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography– Contact and non contact thermal inspection methods–Heat sensitive paints –Heat sensitive papers –-thermally quenched phosphors liquid crystals –techniques for applying liquid crystals –other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo mechanical behavior of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

UNIT - V

Industrial Applications of NDE

Industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions.

Textbooks:

1. J Prasad, GCK Nair ,Non destructive test and evaluation of Materials, Tata mcgraw-Hill Education Publishers, 2008.
2. Josef Krautkrämer, Herbert Krautkrämer, Ultrasonic testing of materials, 3/e, Springer-Verlag, 1983.
3. X. P. V. Maldague, Non destructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

Reference Books:

1. Gary L. Workman, Patrick O. Moore, Doron Kishoni, Non-destructive, Hand Book, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007.
2. ASTM Standards, Vol 3.01, Metals and alloys.

Online Learning Resources:

1. http://www.twivirtualacademy.com/online-courses/ndt/
2. https://www.classcentral.com/course/swayam-theory-and-practice-of-non-destructive- testing-9872
3. https://onlinecourses.nptel.ac.in/noc20_mm07/preview
4. https://www.youtube.com/watch?v=dyMR58TZMbo
5. https://www.youtube.com/watch?v=Wam-Ewcn3aQ
6. https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_NDT_LECTURE_NOTES.pdf
7. https://lecturenotes.in/subject/390/non-destructive-testing

B.Tech (ME)– IV-I Sem

23A03703c	**TOTAL QUALITY MANAGEMENT (Professional Elective-V)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	To introduce the fundamental concepts, definitions, and dimensions of quality and Total Quality Management (TQM).
2	To explore the evolution of quality management through historical perspectives and contributions of quality gurus.
3	To explain the core principles of TQM including customer satisfaction, employee involvement, and continuous improvement.
4	To analyze the various TQM tools such as Benchmarking, QFD, FMEA, Six Sigma, and their role in quality enhancement.
5	To provide an understanding of quality systems like ISO 9000, ISO 14000, QS 9000, and the processes for their implementation.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Define and explain the basic concepts of quality, quality costs, and the scope of Total Quality Management.	L1,L2,L3
2	Summarize the philosophies and contributions of TQM pioneers and evaluate barriers and enablers for TQM implementation.	L1,L2,L5
3	Apply TQM principles such as employee empowerment, customer satisfaction, and supplier partnerships to real-world business scenarios.	L3,L5,L6
4	Analyze the application of tools like QFD, FMEA, Six Sigma, and Benchmarking in improving product and process quality.	L3,L4,L6
5	Evaluate and formulate quality systems like ISO 9000 and ISO 14000, and design documentation and auditing processes.	L5,L6

UNIT - I

Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT - II

Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT - III

TQM Principles: Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies.

UNIT - IV

TQM Tools: Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of

FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

UNIT - V

Quality Systems: Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

Online Learning Resources:

- https://www.youtube.com/watch?v=VD6tXadibk0
- https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
- https://blog.capterra.com/what-is-total-quality-management/
- https://nptel.ac.in/courses/110/104/110104080/
- https://onlinecourses.nptel.ac.in/noc21_mg03/preview
- https://nptel.ac.in/courses/110/104/110104085/
- https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

B.Tech (ME)– IV-I Sem

		L	T	P	C
23A03703d	**SMART MANUFACTURING (Professional Elective-V)**	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Understand the fundamental concepts of Smart Manufacturing, Industry 4.0 and IoT in Manufacturing
2	Understand the fundamental concepts of Data Analytics and Artificial Intelligence in Manufacturing
3	Know about Smart Sensors, RFID, and Block chain in Manufacturing
4	Explain the techniques of Digital Twin & Simulation in Manufacturing
5	Familiarize Sustainable and Green Manufacturing

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Define and explain the evolution of Smart Manufacturing, Industry 4.0 and IoT in Manufacturing	L1,L2,L6
2	Concepts of Data Analytics and Artificial Intelligence in Manufacturing	L2,L4
3	Apply knowledge of Smart Sensors, RFID, and Block chain in Manufacturing	L3,L5,L6
4	Summarise the techniques of Digital Twin & Simulation in Manufacturing	L2,L3,L5,
5	Importance of Sustainable and Green Manufacturing.	L1,L3,L6

Unit – I

Introduction to Smart Manufacturing

Definition, Evolution, and Importance of Smart Manufacturing, Industry 4.0 and Its Impact on Manufacturing, Traditional vs. Smart Manufacturing, Key Technologies in Smart Manufacturing

Cyber-Physical Systems & Industrial IoT (IIoT)

Basics of Cyber-Physical Systems (CPS), Internet of Things (IoT) in Manufacturing, Smart Sensors and Actuators Communication Protocols (MQTT, OPC-UA, Modbus),

Unit – II

Data Analytics and Artificial Intelligence in Manufacturing

Role of Big Data in Manufacturing, Machine Learning & Deep Learning for Smart Manufacturing, Predictive Maintenance and Anomaly Detection, Digital Twin Technology

Automation & Robotics in Smart Manufacturing

Industrial Automation: PLCs, SCADA, and DCS, Autonomous Robots and Cobots (Collaborative Robots), Additive Manufacturing (3D Printing), Case Studies of Smart Factories.

Unit – III
Cloud Computing and Edge Computing in Manufacturing

Introduction to Cloud Computing for Manufacturing, Edge and Fog Computing in Real-time Manufacturing Systems, Cloud-based Manufacturing Execution Systems (MES)

Smart Sensors, RFID, and Block chain in Manufacturing

Role of Smart Sensors and RFID in Inventory Management, Blockchain for Secure Supply Chains Smart Contracts and Decentralized Manufacturing Systems

Unit- IV

Digital Twin & Simulation in Manufacturing

Digital Twin Technology and Virtual Prototyping, Simulation Software for Smart Manufacturing, Augmented Reality (AR) and Virtual Reality (VR) in Industry 4.0

Cybersecurity in Smart Manufacturing

Threats and Risks in Smart Manufacturing, Cybersecurity Frameworks for Industrial Systems, Best Practices for Securing IoT and IIoT Devices

Unit – V

Sustainable and Green Manufacturing

Energy Efficiency in Smart Manufacturing, Sustainable Supply Chain Management, Role of AI in Green Manufacturing

Case Studies and Future Trends

Case Studies of Leading Smart Manufacturing Companies, Emerging Technologies in Smart Manufacturing, Future of Industry 5.0 and Beyond

Text Books:

1. Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013
2. Smart manufacturing by Kamalakar Mutalik The Righte order (2023)

Reference Books:

1. Introduction To Smart Manufacturing And Automation Dr. Rajkumar. E Namya Press (29 March 2024); 213, Vardan Hosue 7/28 Ansari Road Daryganj Delhi 110002.
2. Smart Manufacturing by Michael Deng (Author), Colin Koh Kindle Edition (2023)

Online Learning Resources:

- https://www.youtube.com/watch?v=sdgI072DJNM&pp=ygUUU01BUlQgTUFOVUZBQ1RVUklORyA%3D(2023)

		L	T	P	C
23A03706	**INTRADUCTION TO DRONE TECHNOLOGIES**	**0**	**1**	**2**	**2**

COURSE OBJECTIVES:

1. To learn and understand the fundaments of design, fabrication and programming of drone
2. To teach technical characteristics of the Drone parts and its functions
3. To impart the knowledge of an flying and operation of drone
4. To know about the various applications of drone
5. To understand the safety risks and guidelines of fly safely

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:
CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Create the programs for various drones

UNIT I

INTRODUCTION TO DRONE TECHNOLOGY

Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability

UNIT II

DRONE DESIGN, FABRICATION AND PROGRAMMING

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts - Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program -Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection

UNIT III

DRONE FLYING AND OPERATION

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications

UNIT IV

DRONE COMMERCIAL APPLICATIONS

Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing

UNIT V

FUTURE DRONES AND SAFETY

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms

TEXT BOOKS

1. Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc.
2. Terry Kilby and Belinda Kilby, “Make:Getting Started with Drones “,Maker Media, Inc,

REFERENCES

1. John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016
2. Zavrsnik, “Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance”, Springer, 2018.

Learning resources

https://nptel.ac.in/courses/101108661
https://www.youtube.com/watch?v=iJnuTtUFiWM

B.Tech (ME)– IV-I Sem

		L	T	P	C
23A52702	**GENDER SENSITIZATION (AUDIT COURSE). (Common to All Branches of Engineering)**	**2**	**0**	**0**	**0**

Course Objectives:

- To enable students to understand the gender related issues, vulnerability of women and men
- To familiarize them about constitutional safeguard for gender equality
- To expose the students to debates on the politics and economics of work
- To help students reflect critically on gender violence
- To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.

Course Outcomes (CO):

COs	**Statements**	**Blooms level**
CO1	Understand the basic concepts of gender and its related terminology	L1, L2,
CO2	Identify the biological, sociological, psychological and legal aspects of gender.	L1, L2
CO3	Use the knowledge in understanding how gender discrimination works in our society and how to counter it.	L3
CO4	Analyzethe gendered division of labour and its relation to politics and economics.	L4
CO5	Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups	L5
CO6	Develop students' sensibility with regard to issues of gender in contemporary India	L3

Unit-1UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit-2GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences-Declining Sex Ratio- Demographic Consequences-Gender Spectrum -

Unit-3GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit-4GENDER-BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

Unit-5GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships

Prescribed Books

1. A.Suneetha, Uma Bhrugubanda, et al. *Towards a World of Equals: A Bilingual Textbook on Gender*", Telugu Akademi, Telangana, 2015.
2. Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity*. UK Paperback Edn. March 1990

Reference Books

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India*,London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), *Women in Developing Countries, Assessing Strategies for Empowerment,* London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., *Gender and Governance*, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, *Women and Politics World Wide*, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, *Gender Sensitization: Issues and Challenges* (English, Hardcover), Raj Publications, 2019
6. A.Revathy& Murali, Nandini, *A Life in Trans Activism*(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

Online Resources:

1. Understanding Gender chrome-extension: //kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf

https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

2. Gender Roles and Relations

https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes

https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408

https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

3. Gender and Labour

https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed

https://onlinecourses.nptel.ac.in/noc23_mg67/preview

4. **GENDER-BASED VIOLENCE**

https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en

https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls

https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

5. **GENDER AND CULTURE**

https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/

https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/

https://archive.nptel.ac.in/courses/109/106/109106136/

Abdulali Sohaila. “I Fought For My Life…and Won.”Available online (at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

OPEN ELECTIVES

III B.Tech I Semester

Course Code	GREEN BUILDINGS	L	T	P	C
23A01505a	**(OPEN ELECTIVE - I)**	3	0	0	3

Course Objectives :

The objectives of this course are to make the student:

1. **To understand** the fundamental concepts of green buildings, their necessity, and sustainable features.
2. **To analyze** green building concepts, rating systems, and their benefits in India.
3. **To apply** green building design principles, energy efficiency measures, and renewable energy sources.
4. **To evaluate** air conditioning systems, HVAC designs, and energy modeling for sustainable buildings.
5. **To assess** material conservation strategies, waste management, and indoor environmental quality in green buildings.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

1. **Understand** the importance of green buildings, their necessity, and sustainable features.
2. **Analyze** various green building practices, rating systems, and their impact on environmental sustainability.
3. **Apply** principles of green building design to enhance energy efficiency and incorporate renewable energy sources.
4. **Evaluate** HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.
5. **Assess** material conservation techniques, waste reduction strategies, and indoor air quality management in green buildings.

CO - PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	-	2	3	-	-	-	-	-	3	3
CO -2	-	3	-	-	2	-	3	-	-	-	-	2	3	3
CO -3	-	-	3	3	3	-	3	-	-	-	-	-	3	3
CO -4	-	-	3	3	3	-	3	-	-	-	-	-	3	3
CO -5	-	-	-	-	-	3	3	3	2	-	-	-	-	3

UNIT – I

Introduction to Green Building– Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing A Green Building, Important Sustainable Features for Green Buildings.

UNIT – II

Green Building Concepts and Practices– Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.

UNIT – III

Green Building Design– Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT – IV

Air Conditioning– Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers, Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT – V

Material Conservation– Handling of Non-Process Waste, Waste Reduction During Construction, Materials With Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.

TEXT BOOKS:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by tom woolley and Sam kimings, 2009.

REFRENCE BOOKS:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Energy Conservation Building Code –ECBC-2020, published by BEE

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/102/105102195/

III B.Tech – I Semester

Course Code	CONSTRUCTION TECHNOLOGY AND MANAGEMENT (OPEN ELECTIVE – I)	L	T	P	C
23A01505b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand project management fundamentals, organizational structures, and leadership principles in construction.
2. To analyze manpower planning, equipment management, and cost estimation in civil engineering projects.
3. To apply planning, scheduling, and project management techniques such as CPM and PERT.
4. To evaluate various contract types, contract formation, and legal aspectsin construction management.
5. To assess safety management practices, accident prevention strategies, and quality management systemsin construction.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

1. Understand (Cos)project management fundamentals, organizational structures, and leadership principles in construction.
2. Analyze manpower planning, equipment management, and cost estimationin civil engineering projects.
3. Apply planning, scheduling, and project management techniques such as CPM and PERT.
4. Evaluate various contract types, contract formation, and legal aspectsin construction management.
5. Assess safety management practices, accident prevention strategies, and quality management systems in construction.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	-	2	-	2	2	-	-	-	3	3
CO -2	-	3	-	-	2	-	-	-	-	-	-	2	3	3
CO -3	-	-	3	3	3	-	-	-	-	2	-	-	3	3
CO -4	-	-	3	3	3	-	-	2	-	-	-	-	3	3
CO -5	-	-	-	-	-	3	3	3	2	-	-	-	-	3

UNIT – I

Introduction: Project forms, Management Objectives and Functions; Organizational Chart of A Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics, Morale, Delegation and Accountability.

UNIT – II

Man and Machine: Man-Power Planning, Training, Recruitment, Motivation, Welfare Measures and Safety Laws; Machinery for Civil Engineering., Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation.

UNIT – III

Planning, Scheduling andProject Management: Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network- formulation and Time Computation.

UNIT – IV

Contracts: Types of Contracts, formation of Contract – Contract Conditions – Contract forLabour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH

Standard Bidding Documents – Construction Contracts – Contract Problems – Arbitration and Legal Requirements Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control.

UNIT – V

Safety Management – Implementation and Application of QMS in Safety Programs, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics.

TEXT BOOKS:

1. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley and Sons, 6th Edition, 2016.
2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019
3. Pandey, I.M (2021) Financial Management 12th edition. Pearson India Education Services Pvt. Ltd.

REFRENCE BOOKS:

1. Brien, J.O. andPlotnick, F.L., CPMin Construction Management, Mcgraw Hill, 2010.
2. Punmia, B.C., andKhandelwal, K.K., Project Planning and control with PERT and CPM, Laxmi Publications, 2002.
3. Construction Methods and Management: Pearson New International Edition 8 th Edition Stephens Nunnally.
4. Rhoden, M and Cato B, Construction Management andOrganisational Behaviour, Wiley-Blackwell, 2016.

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/104/105104161/
https://archive.nptel.ac.in/courses/105/103/105103093/

III B.TechISemester

L	T	P	C
3	0	0	3

23A20505 ELECTRICAL SAFETY PRACTICES AND STANDARDS
(Open Elective-I)

Course Outcomes:

CO1: Understanding the Fundamentals of Electrical Safety -L2
CO2: Identifying and Applying Safety Components -L3
CO3: Analyzing Grounding Practices and Electrical Bonding
CO4: Applying Safety Practices in Electrical Installations and Environments- L4
CO5: Evaluating Electrical Safety Standards and Regulatory Compliance -L5

UNIT I IntroductionToElectricalSafety:
Fundamentals ofElectricalsafety-ElectricShock-physiologicaleffects of electric current-Safetyrequirements–Hazardsofelectricity-Arc-Blast-Causesforelectricalfailure.

UNIT II Safety Components:
Introduction to conductors and insulators- voltage classification -safety against over voltages-safety againststaticelectricity-Electricalsafetyequipment's-Fireextinguishersforelectricalsafety.

UNIT III Grounding:
General requirements for grounding and bonding- Definitions- System grounding-Equipment grounding -The Earth-Earthingpractices-Determiningsafeapproachdistance-Determiningarchazardcategory.

UNIT IVSafetyPractices:
Generalfirstaid-Safetyinhandlinghandheldelectricalappliancestools-Electricalsafetyintrain stations-swimmingpools,externallightinginstallations,medicallocations-Casestudies.

UNIT V Standards For Electrical Safety:
Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electricalinspectorate

TEXTBOOKS:

1. MassimoA.G.Mitolo,"ElectricalSafetyofLow-VoltageSystems",McGrawHill,USA,2009.
2. MohamedEl-Sharkawi,"ElectricSafety-PracticeandStandards",CRCPress,USA,2014

REFERENCES:

1. KennethG.Mastrullo, RayA.Jones,"TheElectricalSafetyProgramBook",Jones andBartlettPublishers,London, 2nd Edition, 2011.
2. PalmerHickman,"ElectricalSafety-RelatedWorkPractices",Jones&BartlettPublishers,London,2009.
3. FordhamCooper,W.,"ElectricalSafetyEngineering",ButterworthandCompany,London,1986.
4. JohnCadick,MaryCapelli-Schellpfeffer,DennisK.Neitzel,"ElectricalSafetyHandbook,McGraw-Hill,NewYork,USA, 4th edition, 2012.

III B.Tech – I Sem

L	T	P	C
3	0	0	3

23A03505 SUSTAINBLE ENERGY TECHNOLOGIES
(Open Elective-I)

Course objectives: Theobjectives of the courseareto	
1	To demonstrate the importance the impact of solar radiation, solar PVmodules
2	To understand the principles of storage in PV systems
3	To discuss solar energy storage systems and their applications.
4	To get knowledge in wind energy and bio-mass
5	To gain insights in geothermal energy, ocean energy and fuel cells.

COURSE OUTCOMES On successful completion of this course the student will be able to		
CO1	Illustrate the importance of solar radiation and solar PV modules.	L1, L2
CO2	Discuss the storage methods in PV systems	L2,L3
CO3	Explain the solar energy storage for different applications	L2,L3
CO4	Understand the principles of wind energy, and bio-mass energy.	L2, L3
CO5	Attain knowledge in geothermal energy, ocean energy and fuel cells.	L1, L2,L3, L4

UNIT – 1

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

SOLAR PV MODULES AND PV SYSTEMS:

PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

UNIT – 2

STORAGE IN PV SYSTEMS:

Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

UNIT – 3

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – 4

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT – 5

GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Relative Merits

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH

2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

References:

1. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor &Francis

2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd

3. Renewable Energy Technologies -Ramesh & Kumar /Narosa

4. Non-conventional Energy Source- G.D Roy/Standard Publishers

Online Learning Resources:

https://nptel.ac.in/courses/112106318

https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwIa2X-SuSiNy13

https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3

https://youtu.be/zx04Kl8y4dE?si=VmOvp_OgqisILTAF

III B.Tech I Sem **L – T – P – C**
3 – 0 – 0 – 3

23A04505 **ELECTRONIC CIRCUITS**
(Open Elective –I)

Course Objectives:

1. To understand semiconductor diodes, their characteristics and applications.
2. To explore the operation, configurations, and biasing of BJTs.
3. To study the operation, analysis, and coupling techniques of BJT amplifiers.
4. To learn the operation, applications and uses of feedback amplifiers and oscillators.
5. To analyze the characteristics, configurations, and applications of operational amplifiers.

Course Outcomes:
At the end of this course, the students will be able to

1. Understand semiconductor diodes, their characteristics and applications.
2. Explore the operation, configurations, and biasing of BJTs.
3. Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
4. Learn the operation, applications and uses of feedback amplifiers and oscillators.
5. Analyze the characteristics, configurations, and applications of operational amplifiers.

UNIT-I

Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).

Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode .

UNIT-II

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

UNIT-III

Single stage amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

UNIT-IV

Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).

Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

UNIT-V

Op-amp: Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

Applications of op-amp : Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

TEXT BOOKS:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.

REFERENCE BOOKS:

1. Electronics Devices and Circuits Theory, R.L.Boylestad, LousisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.

III B.Tech I Sem

23A05505a	JAVA PROGRAMMING (Open Elective-I)	L	T	P	C
		3	0	0	3

Course Objectives: The main objective of the course is to Identify Java language components and how they work together in applications

- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception
- handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java apisfor program development

Course Outcomes: After completion of the course, students will be able to
CO1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
CO2: Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects
CO3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.
CO4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
CO5: Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.

Unit – I: Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. Data Types, **Variables, and Operators :**Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.
Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

Unit II:Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.
Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

Unit III: Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors. **Inheritance:** Introduction, Process of Inheritance, Types of Inheritances, Universal Super ClassObject Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of

Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.
Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

Unit IV: Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Autounboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.
Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.
Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

Unit V: String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings,Comparison, Modifying, Searching; Class String Buffer.
Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter thread Communication - Suspending, Resuming, and Stopping of Threads. Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface
Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Learning Resources:
Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Learning Resources:

1. *https://nptel.ac.in/courses/106/105/106105191/*
2. *https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0128804645476188163 47 _shared/overv*iew

III B.Tech I Sem

		L	T	P	C
23A05505b	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (Open Elective-I)**	**3**	**0**	**0**	**3**

Course Objectives:

- To learn the distinction between optimal reasoning Vs. human like reasoning.
- To understand the concepts of state space representation, exhaustive search, heuristic
- search together with the time and space complexities.

- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes:

- Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
- Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
- Learn different knowledge representation techniques.
- Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
- Analyze Supervised Learning Vs. Learning Decision Trees

UNIT - I

Introduction to AI - Intelligent Agents, Problem-Solving Agents,

Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

UNIT-II

Games - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, **Logic-** Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

UNIT-III

First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

UNIT-IV

Planning - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

UNIT-V

ProbabilisticReasoning:
Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

TEXT BOOK:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCE BOOKS:

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

23A05505c	QUANTUM TECHNOLOGIES AND APPLICATIONS Open Elective – I	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamentals of quantum mechanics relevant to quantum technologies.
- To explain key quantum phenomena and their role in enabling novel technologies.
- To explore applications in quantum computing, communication, and sensing.
- To encourage understanding of emerging quantum-based technologies and innovations.

Syllabus

UNIT I: Fundamentals of Quantum Mechanics (7 Hours)

- Classical vs Quantum Paradigm
- Postulates of Quantum Mechanics
- Wavefunction and Schrödinger Equation (Time-independent)
- Quantum states, Superposition, Qubits
- Measurement, Operators, and Observables
- Entanglement and Non-locality

UNIT II: Quantum Computing

- Qubits and Bloch Sphere
- Quantum Logic Gates: Pauli, Hadamard, CNOT, and Universal Gates
- Quantum Circuits
- Basic Algorithms: Deutsch-Jozsa. Gover's, Shor's (conceptual)
- Error Correction and Decoherence

UNIT III: Quantum Communication and Cryptography (7 Hours)

- Teleportation & No-Cloning
- BB84 Protocol
- Quantum Networks & Repeaters
- Classical vs Quantum Cryptography
- Challenges in Implementation

UNIT IV: Quantum Sensors and Metrology

- Quantum Sensing: Principles and Technologies
- Quantum-enhanced Measurements
- Atomic Clocks, Gravimeters
- Magnetometers, NV Centers
- Industrial Applications
-

UNIT V: Quantum Materials and Emerging Technologies

- Quantum Materials: Superconductors, Topological Insulators
- Quantum Devices: Qubits, Josephson Junctions
- National Quantum Missions (India, EU, USA, China)
- Quantum Careers and Industry Initiatives

Textbooks and References

Primary Textbooks:

- "Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang (Cambridge University Press)
- "Quantum Mechanics: The Theoretical Minimum" by Leonard Susskind and Art Friedman (Basic Books)

Supplementary Reading:

- "Quantum Computing for Everyone" by Chris Bernhardt (MIT Press)

• "Quantum Physics: A Beginner's Guide" by Alastair I.M. Rae
• "An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca
• IBM Quantum Experience and Qiskit Documentation (https://qiskit.org/)
Course Outcomes
• Understand key quantum mechanical concepts and phenomena.
• Comprehend the structure and function of quantum algorithms and circuits.
• Explore applications in quantum communication and cryptography.
• Appreciate the role of quantum technologies in modern engineering systems.

III B.Tech I Sem

L	T	P	C
3	0	0	3

23A54501 MATHEMATICS FOR MACHINE LEARNING AND AI

(Open Elective 1)

Course Objectives:

- To provide a strong mathematical foundation for understanding and developing AI/ML algorithms.
- To enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.
- To equip students with optimization techniques and graph-based methods used in AI applications.
- To develop critical problem-solving skills for analysing mathematical formulations in AI/ML.

Course Outcomes:

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

COs	Statements	Blooms level
CO1	Apply linear algebra concepts to ML techniques like PCA and regression.	L3 (Apply)
CO2	Analyze probabilistic models and statistical methods for AI applications.	L4 (Analyze)
CO3	Implement optimization techniques for machine learning algorithms.	L3 (Apply)
CO4	Utilize vector calculus and transformations in AI-based models.	L3 (Apply)
CO5	Develop graph-based AI models using mathematical representations.	L5 (Evaluate)

Course Articulation Matrix:

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

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT I: Linear Algebra for Machine Learning(08)

Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT II: Probability and Statistics for AI(08)

Probability distributions: Gaussian, Binomial, Poisson. Bayes' Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP).Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT III: Optimization Techniques for ML(08)

Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions.Gradient Descent and its variants (Momentum, Adam) Newton's method, BFGS method.

UNIT IV: Vector Calculus & Transformations(08)

Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT V: Graph Theory for AI(08)

Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

Textbooks:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learningby Christopher Bishop, Springer.

Reference Books:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

Web References:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Stanford CS229 – Machine Learning Course https://cs229.stanford.edu/

DeepAI – Mathematical Foundations for AI https://deepai.org

III B.Tech I Sem

23A56501	**MATERIALS CHARACTERIZATION TECHNIQUES** (Common to all branches) (Open Elective-Interdisciplinary) **(Open Elective-I)**	Credits 3-0-0:3

COURSE OBJECTIVES	
1	To provide exposure to different characterization techniques.
2	To explain the basic principles and analysis of different spectroscopic techniques.
3	To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
4	To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
5	To educate the uses of advanced electric and magnetic instruments for characterization.

UNIT I Structure analysis by Powder X-Ray Diffraction 9H

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT II Microscopy technique -1 –Scanning Electron Microscopy (SEM) 9H

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT III Microscopy Technique -2 - Transmission Electron Microscopy (TEM) 9H

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

UNIT IV Spectroscopy techniques 9H

Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT V Electrical & Magnetic Characterization techniques 9H

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Textbooks:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville BanwellandElaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, Prentice Hall , 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. **Materials Characterization Techniques -**Sam Zhang, Lin Li, Ashok Kumar -CRC Press - 2008

NPTEL courses link :

1. https://nptel.ac.in/courses/115/103/115103030/
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

	Course Outcomes	**Blooms Level**
CO1	Analyze the crystal structure and crystallite size by various methods	L1,L2, L3, L4
CO2	Analyze the morphology of the sample by using a Scanning Electron Microscope	L1,L2, L4
CO3	Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope	L1,L2, L3
CO4	Explain the principle and experimental arrangement of various spectroscopic techniques	L1,L2
CO5	Identify the construction and working principle of various Electrical & Magnetic Characterization technique	L1,L2

Course Articulation Matrix:

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

1-Slightly, 2-Moderately, 3-Substantially.

III B.Tech I Sem

Course Code	Title of the Subject	L	T	P	C
23A51501	**CHEMISTRY OF ENERGY SYSTEMS**	3		-	3

COURSE OBJECTIVES	
1	To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2	To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3	To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4	Necessarily of harnessing alternate energy resources such as solar energy and its basic concepts.
5	To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

COURSE OUTCOMES	
CO1	➢ Solve the problems based on electrode potential, Describe the Galvanic Cell ➢ Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2	➢ Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell ➢ Discuss about the Basic design of fuel cells, Classify the fuel cell
CO3	➢ Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, ➢ Interpret advantages of photoelectron catalytic conversion.
CO4	➢ Apply the photo voltaic technology, Demonstrate about solar energy and prospects ➢ Illustrate the Solar cells, Discuss about concentrated solar power
CO5	➢ Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures ➢ Describe the liquification methods.

<u>Mapping between Course Outcomes and Programme Outcomes</u>

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

UNIT-1: Electrochemical Systems: Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction ,Lead-acid ,Nickel-cadmium, Lithium ion batteries and their applications**.**

UNIT-2: Fuel Cells: Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT-3: Photo and Photo electrochemical Conversions: Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT-4: Solar Energy: Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications. .

UNIT-5: Hydrogen Storage: Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel , and Organic hydrogen carriers.

Text books

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

III B.Tech I Sem

Course Code	**ENGLISH FOR COMPETITIVE EXAMINATIONS**	L	T	P	C
23A52502a	**(Open Elective-I)** (Common to All Branches of Engineering)	3	0	0	3

Course Objectives:

1. To enable the students to learn about the structure of competitive English
2. To understand the grammatical aspects and identify the errors
3. To enhance verbal ability and identify the errors
4. To improve word power to answer competitive challenges
5. To make them ready to crack competitive exams

Course Outcomes (CO):	Blooms Level
By the end of the program students will be able to	
▪ Identify the basics of English grammar and its importance	L1, L2
▪ Explain the use of grammatical structures in sentences	L1, L2
▪ Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams	L3
▪ Analyze an unknown passage and reach conclusions about it.	L4
▪ Choose the appropriate form of verbs in framing sentences	L5
▪ Develop speed reading and comprehending ability thereby perform better in competitive exams	L3

UNIT - I	**GRAMMAR-1**	Lecture Hrs

Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite-Degrees of Comparison-Adverbs-types- errors-Conjunctions-usage-Prepositions-usage-Tag Questions, types-identifying errors- Practice

UNIT - II	**GRAMMAR-2**	Lecture Hrs

Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause-Voice-active voice and passive voice- reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices

UNIT - III	**VERBAL ABILITY**	Lecture Hrs

Sentence completion-Verbal analogies-Word groups-Instructions-Critical reasoning-Verbal deduction-Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.

UNIT - IV	**READING COMPREHENSION AND VOCUBULARY**	Lecture Hrs

Competitive Vocabulary :Word Building – Memory techniques-Synonyms, Antonyms, Affixes-Prefix &Suffix-One word substitutes-Compound words-Phrasal Verbs-Idioms and Phrases-Homophones-Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods

UNIT - V	**WRITING FOR COMPETITIVE EXAMINATIONS**	Lecture Hrs

Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs-Essay writing-types

Textbooks:

1. Wren & Martin, *English for Competitive Examinations*, S.Chand & Co, 2021
2. *Objective English for Competitive Examination*, Tata McGraw Hill, New Delhi, 2014.

Reference Books:

1. Hari Mohan Prasad, *Objective English for Competitive Examination,* Tata McGraw Hill, New Delhi, 2014.
2. Philip Sunil Solomon, *English for Success in Competitive Exams*, Oxford 2016

3. Shalini Verma , *Word Power Made Handy*, S Chand Publications
4. Neira, Anjana Dev & Co. *Creative Writing: A Beginner's Manual.* Pearson Education India, 2008.
5. Abhishek Jain,Vocabulary Learning Techniques Vol.I&II,RR Global Publishers 2013.
6. Michel Swan, *Practical English Usage*,Oxford,2006.

Online Resources

1. **https://www.grammar.cl/english/parts-of-speech.htm**
2. **https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech**
3. **https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice**
4. **https://languagetool.org/insights/post/verb-tenses/**
5. **https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council**
6. **https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx**

Course Code	ENTREPRENEURSHIP AND NEW VENTURE CREATION	L	T	P	C
23A52502b	(Open Elective-I)	3	0	0	3

COURSE OBJECTIVES: The objectives of this course are	
1	To foster an entrepreneurial mind-set for venture creation and intrapreneurial leadership.
2	To encourage creativity and innovation
3	To enable them to learn pitching and presentation skills
4	To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept.
5	To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

UNIT-I: Entrepreneurship Fundamentals and context

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16industries to choose from), Venture Activity

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India
- Analyze recent trends in Entrepreneurship role in economic development
- Develop a creative mind set and personality in starting a business.

Unit II: Problem & Customer Identification

Understanding and analysing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analysing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

Core Teaching Tool: Several types of activities including Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the problem and Customer identification.
- Analyze problem and validating with potential customer
- Evaluate customer segmentation and customer personas

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze jobs-to-be-done
- Evaluate customer needs to create a strong value proposition
- Design and draw prototyping and MVP

UNIT-IV: Business & Financial Model, Go-to-Market Plan

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach.

Business planning: components of Business plan- Sales plan, People plan and financial plan.
Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance.

Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy.

Choosing a form of business organization specific to your venture, identifying sources of funds: Debt& Equity, Map the Start-up Life-cycle to Funding Options.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand lean approach in business models
- Apply business plan, sales plan and financial plan
- Analyze financial planning, marketing channels of distribution.
- Design their own venture and source of funds.

UNIT-V: Scale Outlook and Venture Pitch readiness

Understand and identify potential and aspiration for scale vis-a-vis your venture idea.
Persuasive Storytelling and its key components. Build an Investor ready pitch deck.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand aspiration for scale
- Analyze venture idea and its key components
- Evaluate and build investors ready pitch

TEXT BOOKS

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha .

Entrepreneurship, McGrawHill, 11th Edition.(2020)

2. Ries, E. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business,(2011).
3. Osterwalder, A., & Pigneur, Y. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers.* John Wiley & Sons. (2010).

REFERENCES

1. Simon Sinek,*Start with Why,* Penguin Books limited. (2011)
2. Brown Tim,*Change by Design Revised & Updated: How Design Thinking*
3. *Transforms Organizations and Inspires Innovation,* Harper Business.(2019)

4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd.

E-RESOURCES

Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship	L3
CO2	Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution	L3
CO3	Analyze and refine business models to ensure sustainability and profitability	L3
CO4	Build Prototype for Proof of Concept and validate MVP of their practice venture idea	L4
CO5	Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture	L5
CO6	Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders	L6

BTL: Bloom’s Taxonomy Level

III B.Tech.II Semester

Course Code	**DISASTER MANAGEMENT**	L	T	P	C
23A01606a	**(Open Elective – II)**	3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. To analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. To apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. To evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. To assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Course Outcomes:

After successful completion of this course, students will be able to:

1. Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. Apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	-	2	-	2	2	-	-	-	3	3
CO -2	-	3	-	-	2	-	-	-	-	-	-	2	3	-
CO -3	3	-	-	3	-	-	3	-	-	2	-	-	-	3
CO -4	-	-	3	-	3	-	-	2	-	-	-	-	3	-
CO -5	-	-	-	3	-	3	3	3	2	-	-	-	-	3

UNIT – I

Introduction to Natural Disasters– Brief Introduction to Different Types of Natural Disasters, Occurrence of Disasters in Different Climatic and Geographical Regions, Hazard Maps (Earthquake and Cyclone) of The World and India, Regulations for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socioeconomic Consequences).

UNIT – II

Cyclones and Their Impact– Climate Change and Its Impact On Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structuresin Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures Such as Temporary Cyclone Shelters.

UNIT – III

Wind Engineering and Structural Response– Basic Wind Engineering, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Lab: Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects On Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas.

UNIT – IV

Seismology and Earthquake Effects– Causes of Earthquakes, Plate Tectonics, Faults, Seismic Waves; Magnitude, Intensity, Epicenter, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures, Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening.

UNIT – V

Planning and Design Considerations for Seismic Safety– General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Etc.; Seismic Effects Related to Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Details– Various Types of Foundations, Soil Stabilization, Retaining Walls, Plinth Fill, Flooring, Walls, Openings, Roofs, Terraces, Parapets, Boundary Walls, Underground and Overhead Tanks, Staircases, and Isolation of Structures. Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses. Computational Investigation Techniques.

TEXT BOOKS:

1. David Alexander, *Natural Disasters*, 1st Edition, CRC Press, 2017.
2. Edward A. Keller and Duane E. DeVecchio, *Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes*, 5th Edition, Routledge, 2019.

REFRENCE BOOKS:

1. Ben Wisner, J.C. Gaillard, andIlanKelman (Editors), *Handbook of Hazards and Disaster Risk Reduction and Management*, 2nd Edition, Routledge, 2012.
2. Damon P. Coppola, *Introduction to International Disaster Management*, 4th Edition, Butterworth-Heinemann, 2020.
3. BimalKanti Paul, *Environmental Hazards and Disasters: Contexts, Perspectives and Management*, 2nd Edition, Wiley-Blackwell, 2020.

Online Learning Resources:

https://nptel.ac.in/courses/124107010
https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

III B.Tech – II Semester

Course Code	**SUSTAINABILITY IN ENGINEERING PRACTICES (OE – II)**	L	T	P	C
23A01606b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. To analyze sustainable construction materials, their durability, and life cycle assessment.
3. To apply energy calculations in construction materials and assess their embodied energy.
4. To evaluate green building standards, energy codes, and performance ratings.
5. To assess the environmental effects of energy use, climate change, and global warming.

Course Outcomes:

After successful completion of this course, students will be able to:

1. Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. Analyze sustainable construction materials, their durability, and life cycle assessment.
3. Apply energy calculations in construction materials and assess their embodied energy.
4. Evaluate green building standards, energy codes, and performance ratings.
5. Assess the environmental effects of energy use, climate change, and global warming.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	-	2	3	2	-	-	-	-	3	3
CO -2	-	3	-	-	2	-	3	-	-	-	-	2	3	3
CO -3	-	-	3	3	3	-	2	-	-	2	-	-	3	3
CO -4	-	-	3	3	3	-	3	2	-	-	-	-	3	3
CO -5	-	-	-	-	-	3	3	3	-	-	-	-	-	3

UNIT – I

INTRODUCTION

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO_2Contribution From Cement and Other Construction Materials.

UNIT – II

MATERIALS USED in SUSTAINABLE CONSTRUCTION

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT – III

ENERGY CALCULATIONS

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

UNIT – IV

GREEN BUILDINGS

Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings - Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building

UNIT – V		

ENVIRONMENTAL EFFECTS

Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

TEXT BOOKS:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

REFRENCE BOOKS:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practicesin the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/105/105105157/

III B.Tech.II Semester

L	T	P	C
3	0	0	3

23A02605 RENEWABLE ENERGY SOURCES (Open Elective-II)

Course Outcomes (CO): At the end of the course the student will be able to:

CO 1: Understand principle operation of various renewable energy sources. L1
CO 2: Identify site selection of various renewable energy sources. L2
CO 3: Analyze various factors affecting on solar energy measurements, wind energy conversion techniques, Geothermal, Biomasss, Tidal Wave and Fuel cell energies L3
CO 4: Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems. L5
CO 5: Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power. L4

UNIT I Solar Energy:

Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT II PV Energy Systems:

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

UNIT III Wind Energy:

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.

UNIT IV Geothermal Energy:

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT – V Miscellaneous Energy Technologies:

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations.
Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration
Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text books:

1.G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

2.Chetan Singh Solanki "Solar Photovoltaics fundamentals, technologies and applications" 2nd Edition PHI Learning Private Limited. 2012.

Reference Books:

1.Stephen Peake, “Renewable Energy Power for a Sustainable Future”, Oxford International Edition, 2018.

2.S. P. Sukhatme, “Solar Energy”,3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.

3.B H Khan , “ Non-Conventional Energy Resources”, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.

4.S. Hasan Saeed and D.K.Sharma,“Non-Conventional Energy Resources”,3rd Edition, S.K.Kataria& Sons, 2012.

5.G. N. Tiwari and M.K.Ghosal, “Renewable Energy Resource: Basic Principles and Applications”, Narosa Publishing House, 2004.

Online Learning Resources:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

III B. Tech -II Sem

L	T	P	C
3	**0**	**0**	**3**

23A030606 AUTOMATION AND ROBOTICS

(Open Elective – II)

Course objectives: Theobjectives of the courseareto	
1	Fundamentals of industrial automation, production types, automation strategies, and hardware elements used in modern manufacturing processes.
2	Understanding of automated manufacturing systems, and strategies for improving productivity and flexibility in industrial automation.
3	Knowledge of industrial automation and robotics, sensors, and end-effector design for modern manufacturing environments.
4	Explain industrial automation and robotics, and trajectory planning for intelligent and efficient manufacturing applications.
5	Familiarity of industrial automation and robotics, and practical applications in manufacturing processes.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Understand and analyze the structure and functions of automated manufacturing systems, and evaluate hardware components for efficient production.	*L2,L4,L5*
2	Analyze and design automated flow lines with or without buffer storage, perform quantitative evaluations, apply assembly line balancing techniques.	L4,L5,L6
3	Classify robot configurations, select suitable actuators and sensors, analyze and apply automation and robotics principles to optimize production efficiency and flexibility.	L2,L3,L4
4	Apply kinematic and dynamic modeling using D-H notation and select appropriate hardware and control strategies for real-world industrial scenario to analyze and design automated and robotic systems.	L3,L4,L5
5	Design, program, and implement robotic systems, understand and apply robotics technology to manufacturing tasks.	L1,L3,L6

UNIT-I

Introduction to Automation:

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT–II

Automated flow lines:

Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT-III

Introduction to Industrial Robotics:

Introduction to Industrial Robotics,Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

UNIT-IV

Manipulator Kinematics:

Manipulator Kinematics, Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

UNIT-V

Robot Programming:

Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1. Automation,ProductionsystemsandCIM,M.P.Groover/PearsonEdu.
2. IndustrialRobotics -M.P.Groover,TMH.
3.

References:

1. Robotics,FuKS, McGrawHill,4thedition,2010.
2. AnIntroductiontoRobotTechnology,P.CoiffetandM.Chaironze,KogamPageLtd. 1983 London.
3. RoboticEngineering,RichardD.Klafter,PrenticeHall
4. Robotics,FundamentalConceptsandanalysis–AshitaveGhosal,OxfordPress,1/e,2006
5. RoboticsandControl, MittalRK&NagrathIJ,TMH.

OnlineLearningResources:

https://www.youtube.com/watch?v=yxZm9WQJUA0&list=PLRLB5WCqU54UJG45UnazSYmnmhl-gt76o

https://www.youtube.com/watch?v=6f3bvIhSWyM&list=PLRLB5WCqU54X5Vy4DwjfSODT3ZJgwEjyE

III B.Tech II Sem

L – T – P – C 3 – 0 – 0 – 3

23A04606 DIGITAL ELECTRONICS
(Open Elective –II)

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

Course Outcomes:
At the end of this course, the students will be able to

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. Analyze combinational circuits like adders, subtractors, and code converters.
3. Explore combinational logic circuits and their applications in digital design.
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. Gain knowledge about programmable logic devices and digital IC's.

UNIT-I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-II
Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.
UNIT-III
Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.
UNIT-IV
Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.
UNIT-V
Programmable Logic Devices:ROM, Programmable Logic Devices (PLA and PAL).
Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

TEXT BOOKS:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.

REFERENCE BOOKS:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

III B.Tech II Sem

23A32501T	**OPERATING SYSTEMS (Open Elective-II)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives: The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

Course Outcomes: After completion of the course, students will be able to

CO1: Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication. (L1)

CO2: Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection. (L2)

CO3: Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system. (L3)

CO4: Illustrate different conditions for deadlock and their possible solutions. (L2) Analyze the memory management and its allocation policies. (L4)

CO5: Able to design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms,

UNIT - I Operating Systems Overview, System Structures Lecture 8Hrs

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

UNIT - II Process Concept, Multithreaded Programming, Process Scheduling, Inter-process Communication Lecture 10Hrs

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

UNIT - III Memory-Management Strategies, Virtual Memory Management Lecture 8Hrs

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

UNIT - IV Deadlocks, File Systems Lecture 9Hrs

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

UNIT - V System Protection, System Security Lecture 8Hrs

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

Textbooks:

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (Topics: Inter-process Communication and File systems.)

Reference Books:

1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.
2. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw Hill, 2012.
3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

Online Learning Resources:

https://nptel.ac.in/courses/106/106/106106144/
http://peterindia.net/OperatingSystems.html

III B.Tech – II Sem

23A31401T	**MACHINE LEARNING (Open Elective-II)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives: The objectives of the course are

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbors (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

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Course Outcomes:

- CO1: Identify machine learning techniques suitable for a given problem. (L3)
- CO2: Solve real-world problems using various machine learning techniques. (L3)
- CO3: Apply Dimensionality reduction techniques for data preprocessing. (L3)
- CO4: Explain what is learning and why it is essential in the design of intelligent machines. (L2)
- CO5: Evaluate Advanced learning models for language, vision, speech, decision making etc. (L5)

UNIT-I: Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II: Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III: Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression.

The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification | Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV: Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT-V: Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization | Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Textbooks:

1."Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

1.“Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017
2.“Machine Learning in Action”,Peter Harrington, DreamTech
3.“Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

III B.Tech II Sem

L	T	P	C
3	0	0	3

23A54601a OPTIMIZATION TECHNIQUES
(Open Elective -II)

Course Outcomes:

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

COs	Statements	Blooms level
CO1	Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.	L2, L3
CO2	Interpret the transportation models' solutions and infer solutions to the real-world problems.	L3, L5
CO3	Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.	L3
CO4	Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives	L2, L3
CO5	Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives.	L3,L5

Course Articulation Matrix:

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

1-Slightly, 2-Moderately, 3-Substantially.

UNIT – I: Linear programming I (08)

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

UNIT – II Linear programming II: Duality in Linear Programming (08)

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

UNIT – III Non-linear programming: Unconstrained optimization techniques (08)

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT – IV Non-linear programming: Constrained optimization techniques (08)

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT-V Geometric Programming (08)

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

TEXT BOOK:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

REFERENCES:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

Web Reference:

- https://onlinecourses.nptel.ac.in/noc24_ee122/preview
- https://archive.nptel.ac.in/courses/111/105/111105039/
- https://onlinecourses.nptel.ac.in/noc21_ce60/preview

23A54601b	MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES Open Elective – II	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide students with essential linear algebra foundations including vector spaces, inner products, and operators for quantum mechanical applications.
- To develop understanding of the transition from finite-dimensional systems to infinite-dimensional function spaces and Hilbert space concepts.
- To establish quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution principles.
- To enable students to apply quantum mechanical principles to solve problems in simple quantum systems and understand statistical interpretation.
- To introduce advanced concepts in composite systems, measurement processes, and modern perspectives in quantum mechanics.

Course Outcomes:

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

COs	Statements	Blooms level
CO1	Understand vector spaces, inner products, and linear operators with applications to quantum systems.	L1, L2 (Understand, Comprehend)
CO2	Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite dimensional systems.	L3, L4 (Apply, Analyze)
CO3	Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.	L4 (Analyze)
CO4	Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations.	L3, L5 (Apply, Evaluate)
CO5	Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum theory.	L5, L6 (Evaluate, Create)

Course Articulation Matrix:

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

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT I: Linear Algebra Foundation for Quantum Mechanics (10 hours)

Vector spaces definition and examples (R^2, R^3, function spaces), Inner products (dot product, orthogonality, normalization), Linear operators (matrices, eigenvalues, eigenvectors), Finite-dimensional examples (2×2 matrices, spin-1/2 systems), Dirac notation introduction (|ψ⟩, ⟨φ|, ⟨φ|ψ⟩), Change of basis (transformations, unitary matrices).

UNIT II: From Finite to Infinite Dimensions (08 hours)

Function spaces (L^2 space, square-integrable functions), Inner products for functions (∫ψ*φ dx), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions (d/dx, multiplication by x).

UNIT III: Quantum Mechanical Formalism (08 hours)

Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrödinger equation, unitary evolution).

UNIT IV: Applications and Statistical Interpretation (06 hours)

Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

UNIT V: Advanced Topics (08 hours)

Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

Textbooks:

1. David J. Griffiths, Darrell F. Schroeter, “Introduction to Quantum Mechanics”, 3rd Edition, Cambridge University Press (2018).
2. R. Shankar, Principles of Quantum Mechanics, 2nd Edition, Kluwer Academy/Plenum Publishers (1994).

Reference Books:

1. George. F. Simmons, “Introduction to Topology and Modern Analysis”,MedTech Science Press.
2. Gilbert Strang, Linear Algebra and Its Applications, 4th Edition, Cengage Learning (2006).
3. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics,Princeton Univ. Press (1996).

Web Resources

1. https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20-%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf
2. https://fisica.net/mecanica-quantica/Shankar%20-%20Principles%20of%20quantum%20mechanics.pdf

III B.Tech II Sem

23A56601	**PHYSICS OF ELECTRONIC MATERIALS AND DEVICES** (Common to all branches) Open Elective-II	Credits 3-0-0:3

Course Objectives	
1	To make the students to understand the concept of crystal growth, defects in crystals and thin films.
2	To provide insight into various semiconducting materials and their properties.
3	To develop a strong foundation in semiconductor physics and device engineering.
4	To elucidate excitonic and luminescent processes in solid-state materials.
5	To understand the principles, technologies, and applications of modern display systems.

UNIT-I **Fundamentals of Materials Science** **9H**

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT II Semiconductors **9H**

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT III Physics of Semiconductor Devices: **9H**

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

UNIT IV Excitons and Luminescence: **9H**

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials.

Photoluminescence : General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot.

Electro-luminescence : General Principles of electroluminescence, light emitting diode, diode laser.

UNIT V Display devices : **9H**

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Textbooks:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4thedition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, DhanpatRai and Co., New Delhi., 2012.

4. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition,2011

NPTEL course links:
https://nptel.ac.in/courses/113/106/113106062/

https://onlinecourses.nptel.ac.in/noc20_ph24/preview

	Course Outcomes	**Blooms Level**
CO1	Understand crystal growth and thin film preparation	L1,L2
CO2	Summarize the basic concepts of semiconductors	L1,L2
CO3	Illustrate the working of various semiconductor devices	L1,L2, L3
CO4	Analyze various luminescent phenomena and the devices based on these concepts	L1,L2, L3
CO5	Explain the working of different display devices	L1,L2

Course Articulation Matrix:

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

1-Slightly, 2-Moderately,3-Substantially.

III B.Tech –II Sem

23A51601	**CHEMISTRY OF POLYMERS AND APPLICATIONS** (Common to all branches) Open Elective-II	Credits 3-0-0:3

Course Objectives	
1	To understand the basic principles of polymers
2	To understand natural polymers and their applications.
3	To impart knowledge to the students about synthetic polymers, their preparation and importance.
4	To enumerate the applications of hydogel polymers
5	To enumerate applications of conducting and degradable polymers in engineering.

Course Outcomes	
CO1	Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2	Describe the physical and chemical properties of natural polymers and Modified cellulosics.
CO3	Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
CO4	Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,
CO5	Explain classification and mechanism of conducting and degradable polymers.

<u>**Mapping between Course Outcomes and Programme Outcomes**</u>

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

Unit – I: Polymers-Basics and Characterization:-

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit – II: Natural Polymers & Modified cellulosics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit – III: Synthetic Polymers

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

Unit-IV: Hydrogels of Polymer networks

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels**,** Applications of hydrogels in drug delivery.

Unit – V: Conducting and Degradable Polymers:

Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping,Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Text Books:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

References Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall

2.Advanced Organic Chemistry, B.Miller, Prentice Hall

3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

III B.Tech –II Sem

Course Code	Course Title	L	T	P	C
23A52602	**ACADEMIC WRITING AND PUBLIC SPEAKING (Common to All Branches of Engineering) OPEN ELECTIVE - II**	**3**	**0**	**0**	**3**

Course Objectives:

- To encourage all round development of the students by focusing on writing skills
- To make the students aware of non-verbal skills
- To develop analytical skills
- To deliver effective public speeches

Course Outcomes (CO):	Blooms Level
By the end of the program students will be able to	
• Understand various elements of Academic Writing	L1, L2
• Identify sources and avoid plagiarism	L1, L2
• Demonstrate the knowledge in writing a Research paper	L3
• Analyse different types of essays	L4
• Assess the speeches of others and know the positive strengths of speakers	L5
• Build confidence in giving an impactful presentation to the audience	L3

UNIT - I	Introduction to Academic Writing	Lecture Hrs

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT - II	Academic Journal Article	Lecture Hrs

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism

UNIT - III	Essay & Writing Reviews	Lecture Hrs

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP

UNIT - IV	Public Speaking	Lecture Hrs

Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events

UNIT - V	Public Speaking and Non-Verbal Delivery	Lecture Hrs

Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics - Paralanguage - Signs

Textbooks:

1. *Critical Thinking, Academic Writing and Presentation Skills*: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)
2. Pease, Allan & Barbara. *The Definitive Book of Body Language*RHUS Publishers, 2016

Reference Books:

1. Alice Savage, Masoud Shafiei *Effective Academic Writing,**2Ed.,***2014 .sserP ytisrevinU drofxO
2. Shalini Verma, *Body Language*, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata,*Communication Skills* 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson,*Technical Communication Process and Product,* Pearson, New Delhi, 2014
5. *Elbow, Peter. Writing with Power. OUP USA, 1998*

Online Learning Resources:

1. https://youtu.be/NNhTIT81nH8
2. phttps://www.youtube.com/watch?v=478ccrWKY-A
3. https://www.youtube.com/watch?v=nzGo5ZC1gMw
4. https://www.youtube.com/watch?v=Qve0ZBmJMh4
5. https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of-delivery/
6. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
7. https://archive.nptel.ac.in/courses/109/107/109107172/#
8. https://archive.nptel.ac.in/courses/109/104/109104107/

IV B.Tech – I Semester

Course Code	BUILDING MATERIALS AND SERVICES (OPEN ELECTIVE – III)	L	T	P	C
23A01704a		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. To analyze the composition, manufacturing process, and properties of cement and admixtures.
3. To apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. To evaluate masonry, mortars, finishing techniques, and formwork systems.
5. To assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. Analyze the composition, manufacturing process, and properties of cement and admixtures.
3. Apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. Evaluate masonry, mortars, finishing techniques, and formwork systems.
5. Assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	2	-	-	-	-	-	-	-	3	3
CO -2	3	3	-	-	2	-	-	-	-	-	-	2	3	3
CO -3	3	-	3	2	3	-	-	-	-	-	-	-	3	3
CO -4	-	-	3	3	3	-	2	-	-	-	-	-	3	3
CO -5	-	-	-	-	-	3	3	2	-	-	-	-	-	3

UNIT – I

StonesandBricks, Tiles: Building Stones – Classifications and Quarrying – Properties – Structural Requirements – Dressing. Bricks – CompositionofBrick Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics. Timber, Aluminum, Glass, PaintsandPlastics: Wood - Structure – Types and Properties – Seasoning – Defects; Alternate Materials for Timber – GI / Fibre – Reinforced Glass Bricks, Steel & Aluminum, Plastics.

UNIT – II

Cement &Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency – Initial &Final Setting – Soundness . Admixtures – Mineral & Chemical Admixtures – Uses

UNIT – III

Building Components: Lintels, Arches, Walls, Vaults – Stair Cases – Types of Floors, Types of Roofs – Flat, Curved, Trussed; Foundations – Types; Damp Proof Course; Joinery – Doors – Windows – Materials – Types.

UNIT – IV

Mortars, MasonryandFinishing's Mortars: Lime and Cement Mortars Brick Masonry – Types – Bonds; Stone Masonry – Types; Composite Masonry – Brick-Stone Composite; Concrete, Reinforced Brick. Finishers: Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP.form Work: Types: Requirements – Standards – Scaffolding – Design; Shoring, Underpinning.

UNIT – V

Building Services: Plumbing Services: Water Distribution, Sanitary – Lines &Fittings; Ventilations: Functional Requirements Systems of Ventilations. Air-Conditioning - Essentials andTypes; Acoustics – Characteristic – Absorption – Acoustic Design; Fire Protection – Fire Hazards – Classification of Fire Resistant Materials and Constructions.

TEXT BOOKS:

1. Building Materials and Construction – Arora&Bindra, Dhanpat Roy Publications.
2. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.

REFRENCE BOOKS:

1. Building Construction by B. C. Punmia, Ashok Kumar Jain andArun Kumar Jain - Laxmi Publications (P) ltd., New Delh
2. P. C. Varghese, Building Materials, Prentice Hall of India, 2015.
3. N.Subramanian ,"Building Materials Testing and Sustainability", Oxford Higher Education, 2019.
4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.
5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/102/105102088/

IV B.Tech – I Semester

Course Code	ENVIRONMENTAL IMPACT ASSESSMENT (OPEN ELECTIVE – III)	L	T	P	C
23A01704b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
2. Analyze the impact of developmental activities on land use, soil, and water resources.
3. Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
4. Develop environmental audit procedures and assess compliance with environmental regulations.
5. Understand and apply environmental acts, notifications, and legal frameworks in EIA studies.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

1. Apply various methodologies for conducting Environmental Impact Assessments.
2. Analyze the impact of land-use changes on soil, water, and air quality.
3. Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
4. Develop environmental audit reports and assess compliance with environmental policies.
5. Interpret and apply environmental acts and regulations related to EIA.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	2	2	2	2	3	-	-	-	-	-	1	2	2
CO -2	3	3	3	2	2	3	-	-	-	-	-	1	3	2
CO -3	3	3	3	2	2	3	3	-	-	-	-	1	3	3
CO -4	3	3	3	3	2	3	3	-	-	-	-	1	3	3
CO -5	2	2	2	2	2	3	3	3	-	-	-	1	2	2

UNIT – I

Concepts and methodologies of EIA

Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters-Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT – II

Impact of Developmental Activities and Land Use

Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I Ain Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts On Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT – III

Assessment of Impact On Vegetation, Wildlife and Risk Assessment

Introduction - Assessment of Impact of Development Activities On Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing An Environmental Risk Assessment-Advantages of Environmental Risk Assessment.

UNIT – IV

Environmental Audit

Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

UNIT – V

Environmental Acts and Notifications

The Environmental Protection Act, The Water Preservation Act, The Air (Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, ConceptofISO and ISO 14000.

TEXT BOOKS:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011
2. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)

REFRENCE BOOKS:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985.
2. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi
3. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Online Learning Resources:

https://archive.nptel.ac.in/courses/124/107/124107160/

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

23A02704 SMART GRID TECHNOLOGIES
(Open Elective- III)

Course Outcomes:
CO1: Understanding the Concept and Evolution of Smart Grids. L2
CO2: Analyzing Wide Area Monitoring System and Synchrophasor Technology. L4
CO3: Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts. L3
CO4: Evaluating Information and Communication Technology (ICT) Systems in Smart Grids. L5
CO5: Designing Smart Grid Applications and Cybersecurity Measures. L6

UNIT I Introduction to Smart Grid :
Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid road map for India – Smart Grid Architecture.

UNIT II Wide Area Monitoring System :
Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchrophasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

UNIT III Smart Meters:
Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

UNIT IV Information and Communication Technology:
Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.

UNIT V**Smart Grid Applications and Cyber Security**:
Applications : Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid – House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

TEXT BOOKS:
1. James Momoh, "SMART GRID : Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

REFERENCES:

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.

2. Fereidoon.P.Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.

3. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.

4. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

23A03704 **3D PRINTING TECHNOLOGIES**
(Open Elective-III)

Course objectives: Theobjectives of the courseareto	
1	**Understand** the fundamental concepts of prototyping and distinguish between traditional and rapid prototyping methods.
2	**Demonstrate** the working principles, materials, and applications of solid-, liquid-, and powder-based RP systems.
3	**Define** the processes and classifications of rapid tooling and reverse engineering techniques.
4	**Identify** common errors in 3D printing and evaluate pre-processing, processing, and post-processing issues.
5	**Familiarize** RP-related software and its role in applications such as design, manufacturing, and medical fields.

Course Outcomes: Onsuccessfulcompletionofthecourse, thestudentwillbeable to,		
1	Define and explain the evolution and need for rapid prototyping in modern product development.	L1,L2,L6
2	Compare and contrast various 3D printing technologies based on working principles, materials, and limitations.	L2,L4
3	Apply knowledge of rapid tooling and reverse engineering techniques for industrial and design applications.	L3,L5,L6
4	Diagnose and interpret different types of errors encountered in 3D printing processes and recommend solutions.	L2,L3,L5,
5	Use RP-specific software tools to manipulate STL files and prepare models for printing in real-world scenarios.	L1,L3,L6

UNIT I Introduction to 3D Printing
Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT II Solid and Liquid Based RP Systems
Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

UNIT III Powder Based & Other RP Systems
Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).
Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballastic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

UNIT IV Rapid Tooling & Reverse Engineering
Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.
Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development
UNIT V
Errors in 3D Printing and Applications:
Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP. Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Textbooks:

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, Springer, 2/e, 2010.

Reference Books:

1. Frank W.Liou, “Rapid Prototyping & Engineering Applications”, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley&Sons, 2006.

Online Learning Resources:

- NPTEL Course on Rapid Manufacturing.
- https://nptel.ac.in/courses/112/104/112104265/
- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-
- %20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdfcompressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4.

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

23A04503T MICROPROCESSORS AND MICROCONTROLLERS
(Open Elective –III)

Course Objectives:

1. To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
2. To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

Course Outcomes:
At the end of this course, the students will be able to

1. Gain knowledge on the architecture, operation, and configurations of the 8086 microprocessors.
2. Get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. Know the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. Learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. Understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

UNIT I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT IV

Microcontroller - Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V

Interfacing Microcontroller - Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.

2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

IV B.Tech-I Sem

23A05402T	**DATA BASE MANAGEMENT SYSTEM (Open Elective-III)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives: The main objective of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes: After completion of the course, students will be able to

- Understand the basic concepts of database management systems (L2)
- Analyze a given database application scenario to use ER model for conceptual design of the database (L4)
- Utilize SQL proficiently to address diverse query challenges (L3).
- Employ normalization methods to enhance database structure (L3)
- Assess and implement transaction processing, concurrency control and database recovery protocols in databases. (L4)

UNIT I: Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Unit II: Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III: SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV: Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V: Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Textbooks:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

IV B.Tech-I Sem

23A38502	INTRODUCTION TO CYBER SECURITY (Open Elective-III)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the concept of cybercrime and its impact on information security, and provide an overview of cybercriminal behavior and various classifications of cybercrimes.
2. To explore the methodologies used by cybercriminals to plan and execute attacks, including techniques like social engineering, botnets, and cloud-related threats.
3. To understand the security risks associated with mobile and wireless devices, and examine countermeasures for securing mobile computing in organizational environments.
4. To familiarize students with the tools and techniques used in committing cybercrimes, such as phishing, malware, DoS/DDoS attacks, and code-based exploits.
5. To analyze the implications of cybercrime for organizations, including the cost of cyber attacks, intellectual property issues, and challenges posed by social computing and web-based threats.

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamentals of cybercrime and information security, and explain the legal and global perspectives, especially with reference to Indian IT Act 2000.
2. Analyze how cybercriminals plan and execute cyber offenses using techniques like social engineering, cyber stalking, and botnets, including threats posed by cloud computing.
3. Evaluate the security challenges of mobile and wireless devices and formulate measures to secure mobile environments within an organization.
4. Identify and explain various cyber attack tools and methods such as phishing, keyloggers, Trojans, and SQL injection used in committing cybercrimes.
5. Assess the organizational implications of cybercrimes, including IPR issues, social media risks, and formulate strategies to mitigate security and privacy challenges.

UNIT I Introduction to Cybercrime

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT II Cyber Offenses: How Criminals Plan Them

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT III Cybercrime: Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones,

Mobile Devices:

Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT IV Tools and Methods Used in Cybercrime

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT V Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J.DavidIrwin.CRC Press T&F Group

Online Learning Resources:

http://nptel.ac.in/courses/106105031/40

http://nptel.ac.in/courses/106105031/39

http://nptel.ac.in/courses/106105031/38

IV B.Tech I Sem

L	T	P	C
3	0	0	3

23A54701 WAVELET TRANSFORMS AND ITS APPLICATIONS
(Open Elective-III)

Course Outcomes:
After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms	L2, L3
CO2	Illustrate the multi resolution analysis ad scaling functions	L3, L5
CO3	Implement discrete wavelet transforms with multirate digital filters	L3
CO4	Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.	L2, L3
CO5	Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields	L3,L5

Course Articulation Matrix:

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

1-Slightly, 2-Moderately, 3-Substantially.

UNIT – I: Wavelets (08)

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms.

UNIT – II: A Multiresolution Formulation of Wavelet Systems (08)

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT – III Filter Banks and the Discrete Wavelet Transform (08)

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

UNIT – IV Time-Frequency and Complexity (08)

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms - The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

UNIT-V Bases and Matrix Examples (08)

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

TEXT BOOK:

1. C. Sidney Burrus, Ramesh A. Gopinath, “Introduction to Wavelets and Wavelets Transforms”, Prentice Hall, (1997).
2. James S. Walker, “A Primer on Wavelets and their Scientific Applications”, CRC Press, (1999)..

REFERENCES:

1. RaghuveerRao, “Wavelet Transforms”, Pearson Education, Asia

2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

1. http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html

2. http://www.wavelet.org/

3. http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.htm

4. https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-of-waveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf

IV B.Tech I Sem

23A56701a	**SMART MATERIALS AND DEVICES** (Common to all branches) **Open Elective-III**	Credits 3-0-0:3

Course Objectives	
1	To provide exposure to smart materials and their engineering applications.
2	To impart knowledge on the basics and phenomenon behind the working of smart materials
3	To explain the properties exhibited by smart materials
4	To educate various techniques used to synthesize and characterize smart materials
5	To identify the required smart material for distinct applications/devices

UNIT I Introduction to Smart Materials 9H

Historical account of the discovery and development of smart materials, Shape memory materials, chromoactive materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT II Properties of Smart Materials 9H

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III Synthesis of Smart Materials 9H

Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV Characterization Techniques 9H

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT V Smart Materials based Devices 9H

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Textbooks:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2017
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. Gauenzi,P.,Smart Structures, Wiley, 2009.
2. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. **Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0,**Chaudhery MustansarHussain, Paolo Di Sia, Springer,2022.
4.**Fundamentals of Smart Materials,**Mohsen Shahinpoor, Royal Society of Chemistry, 2020

NPTEL course link: https://onlinecourses.nptel.ac.in/noc22_me17/preview

	Course Outcomes	**Blooms Level**
CO1	Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.	L1,L2, L3, L4
CO2	Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.	L1,L2, L3

CO3	Summarize various types of synthesis of smart materials	L1,L2, L3
CO4	Analyze various characterization techniques used for smart materials	L1,L2, L3
CO5	Interpret the importance of smart materials in various devices	L1,L2

Course Articulation Matrix:

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

1-Slightly, 2-Moderately, 3-Substantially.

		L	T	P	C
23A56701b	**INTRODUCTON TO QUANTUM MECHANICS** **Open Elective – III**	**3**	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To understand the fundamental differences between classical and quantum mechanics.
2	To study wave-particle duality, uncertainty principle, and their implications.
3	To learn and apply Schrödinger equations to basic quantum systems.
4	To use operator formalism and mathematical tools in quantum mechanics.
5	To explore angular momentum, spin and their quantum mechanical representations.

UNIT- I: PRINCIPLES OF QUANTUM MECHANICS
Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation.Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle.Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT- II: ONE DIMENSIONAL PROBLEMS AND SOLUTIONS
Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT-III: OPERATOR FORMALISM
Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT- IV: MATHEMATICAL TOOLS FOR QUANTUM MECHANICS
The concept of row and column matrices, Matrix algebra,Hermitian operators – definition. Dirac's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT- V : ANGULAR MOMENTUM AND SPIN
Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half(1/2), Spin angular momentum, Pauli's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

BOOKS FOR STUDY:

1. Quantum Mechanics. Vol 1, A. MessaiaNoth-Holland Pub. Co., Amsterdam,(1961).
2. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkatesam, Tata McGraw Hill, New Delhi,(1976).
3. Introduction to Quantum Mechanics. R.H.Dicke and J.P.Witke, Addison-Wisley Pub.Co.Inc.,London, (1960).
4. Quantum Mechanics. S.L.Gupta, V.Kumar, H.V.Sarama and R.C.Sharma, Jai PrakashNath& Co, Meerut, (1996).

REFERENCE BOOKS:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).

2. Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.) 2003.

	CourseOutcomes After completing this course, students will be able to:	**Blooms Level**
CO1	Explain the key principles of quantum mechanics and wave-particle duality	L1, L2
CO2	Apply Schrödinger equations to solve one-dimensional quantum problems	L3, L4
CO3	Solve quantum mechanical problems using operator and matrix methods.	L2, L4
CO4	Evaluate quantum states using Dirac notation and expectation values.	L5
CO5	Analyze angular momentum and spin systems using Pauli matrices and operators.	L4, L5

NPTEL courses link :

4. https://archive.nptel.ac.in/courses/115/101/115101107/
5. https://archive.nptel.ac.in/courses/122/106/122106034/
6. https://nptel.ac.in/courses/115106066

CourseArticulationMatrix:

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

1-Slightly, 2-Moderately, 3-Substantially.

IV B.Tech I Sem

23A51701	**GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT** (Common to all branches) **Open Elective-III**	Credits 3-0-0:3

Course Objectives	
1	**To Understand Principle And Concepts Of Green Chemistry.**
2	**To Understand The Types Of Catalysis And Industrial Applications.**
3	**To Apply Green Solvents In Chemical Synthesis.**
4	**To Enumerate Different Sourced Of Green Energy.**
5	**To Apply Alternative Greener Methods Foe Chemical Reactions**

Course Outcomes	
CO1	Apply the Green chemistry Principles for day to day life as well as synthesis, describe the sustainable development and green chemistry, Explain economic and un-economic reactions, Demonstrate Polymer recycling.
CO2	Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis
CO3	Demonstrate Green solvents and importance, Discuss Supercritical carbondioxide, Explain Supercritical water, recycling of green solvents.
CO4	Describe importance of Biomass and Solar Power, Illustrate Sonochemistry, Apply Green Chemistry for Sustainable Development; discuss the importance of Renewable resources, mechanochemical synthesis.
CO5	Discuss Alternative green methods like Photoredox catalysis, single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Mapping between Course Outcomes and Programme Outcomes

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

UNIT 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling

UNIT 2: CATALYSIS AND GREEN CHEMISTRY

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio-catalysis and Photo-catalysis with examples.

UNIT 3: GREEN SOLVENTS IN CHEMICAL SYNTHESIS

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recyling of green solvents.

UNIT 4: EMERGING GREENER TECHNOLOGIES

Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT 5: ALTERNATIVE GREENER METHODS

Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Text Books :

1. **M. Lancaster, Green Chemistry An Introductory Text, Royal Society Of Chemistry, 2002.**
2. **Paul T. Anastas And John C. Warner, Green Chemistry Theory And Practice, 4th Edition, Oxford University Press, Usa**

References :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: **Green Nanoscience, wiley-VCH, 2013.**

IV B.Tech I Sem

Course Code	EMPLOYABILITY SKILLS	L	T	P	C
23A52703	OPEN ELECTIVE-III	3	0	0	3

Course Objectives:

- To encourage all round development of the students by focusing on productive skills
- To make the students aware of Goal setting and writing skills
- To enable them to know the importance of presentation skills in achieving desired goals.
- To help them develop organizational skills through group activities

To function effectively with heterogeneous teams

Course Outcomes (CO):	Blooms Level
CO1: Understand the importance of goals and try to achieve them	L1, L2
CO2: Explain the significance of self-management	L1, L2
CO3: Apply the knowledge of writing skills in preparing eye-catchy resumes	L3
CO4: Analyse various forms of Presentation skills	L4
CO5: Judge the group behaviour appropriately	L5
CO6: Develop skills required for employability.	L3, L6

UNIT - I	**Goal Setting and Self-Management**	Lecture Hrs

Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

UNIT - II	**Writing Skills**	Lecture Hrs

Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)

UNIT - III	**Technical Presentation Skills**	Lecture Hrs

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics – Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation

UNIT - IV	**Group Presentation Skills**	Lecture Hrs

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion-Debate –Corporate Etiquette

UNIT - V	**Job Cracking Skills**	Lecture Hrs

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

Textbooks:

1. Sabina Pillai, Agna Fernandez. *Soft Skills & Employability Skills*,2014.Cambridge Publisher.
2. Alka Wadkar. *Life Skills for Success*, Sage Publications, 2016.

Reference Books:

1. Gangadhar Joshi. *Campus to Corporate Paperback* , Sage Publications. 2015
2. Sherfield Montogomery Moody,*Cornerstone Developing Soft Skills*, Pearson Publications. 4 Ed. 2008
3. Shikha Kapoor. *Personality Development and Soft Skills - Preparing for Tomorrow* .1 Edition, Wiley, 2017.
4. M. Sen Gupta, *Skills for Employability*, Innovative Publication, 2019.
5. Steve Duck and David T McMahan, *The Basics f Communication Skills A Relational Perspective*, Sage press, 2012.

Online Learning Resources:

1. https://youtu.be/gkLsn4ddmTs
2. https://youtu.be/2bf9K2rRWwo
3. https://youtu.be/FchfE3c2jzc
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
5. https://www.youtube.com/c/skillopedia/videos
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
8. https://archive.nptel.ac.in/courses/109/107/109107172/#

9. https://archive.nptel.ac.in/courses/109/104/109104107/

IV B.Tech – I Semester

Course Code	GEO-SPATIAL TECHNOLOGIES (OPEN ELECTIVE – IV)	L	T	P	C
23A01705a		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. To analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. To apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
4. To evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. To assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. Apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
4. Evaluate surface andgeostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. Assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

CO – PO Articulation Matrix

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO -1	3	-	-	-	2	-	-	-	-	-	-	-	3	3
CO -2	3	3	-	-	2	-	-	-	-	-	-	2	3	3
CO -3	3	-	3	2	3	-	-	-	-	-	-	-	3	3
CO -4	-	-	3	3	3	-	2	-	-	-	-	-	3	3
CO -5	-	-	-	-	3	3	3	2	-	-	-	-	3	3

UNIT – I

RASTER ANALYSIS

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering – Extended Neighborhood-Operations- Zonal Operations - Statistical Analysis – Cost-Distance Analysis-Least Cost Path.

UNIT – II

VECTOR ANALYSIS

Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance – topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line-In-Polygon,

Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering

UNIT – III

NETWORK ANALYSIS

Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path in A Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis

UNIT – IV

SURFACE and GEOSTATISTICAL ANALYSIS

Surface Data – Sources of X,Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram.

UNIT – V

CUSTOMISATION, WEB GIS, MOBILE MAPPING

Customisation of GIS: Need, Uses, Scripting Languages –Embedded Scripts – Use of Python Script - Web GIS: Web GIS Architecture, Advantages of Web GIS, Web Applications- Location Based Services: Emergency and Business Solutions - Big Data Analytics.

TEXT BOOKS:

1. Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008.
2. Lo, C.P. andYeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

REFRENCE BOOKS:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley,2009
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, “An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub.,2008

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/105/105105202/
https://onlinecourses.nptel.ac.in/noc19_cs76/preview

IV B.Tech – I Semester

Course Code	SOLID WASTE MANAGEMENT (OPEN ELECTIVE – IV)	L	T	P	C
23A01705b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. To analyze engineering systems for solid waste collection, storage, and transportation.
3. To apply resource and energy recovery techniques for sustainable solid waste management.
4. To evaluate landfill design, construction, and environmental impact mitigation strategies.
5. To assess hazardous waste management techniques, including biomedical and e-waste disposal.

Course Outcomes:

1. Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. Analyze engineering systems for solid waste collection, storage, and transportation.
3. Apply resource and energy recovery techniques for sustainable solid waste management.
4. Evaluate landfill design, construction, and environmental impact mitigation strategies.
5. Assess hazardous waste management techniques, including biomedical and e-waste

CO – PO Articulation Matrix

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO -1	3	-	-	-	2	-	2	-	-	-	-	-	3	3
CO -2	3	3	-	-	2	-	3	-	-	-	-	2	3	3
CO -3	3	-	3	2	3	-	3	-	-	-	-	-	3	3
CO -4	-	-	3	3	3	-	3	2	-	-	-	-	3	3
CO -5	-	-	-	-	3	3	3	3	-	-	-	-	3	3

UNIT – I

Solid Waste: Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes, Elements of Solid Waste Management - Integrated Solid Waste Management, Solid Waste Management Rules 2016.

UNIT – II

Engineering SystemsforSolid Waste Management: Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning - Transfer and Transport; Processing Techniques;

UNIT – III

Engineering Systems for Resource and Energy Recovery: Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products – Composting, Pre and Post Processing, Types of Composting, Critical Parameters, Problems With Composing - Recovery of Thermal Conversion Products; Pyrolisis, Gasification, RDF - Recovery of Energy From Conversion Products; Materials and Energy Recovery Systems.

UNIT – IV

Landfills: Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills – Types of Liners – Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation.

UNIT – V

Hazardous Waste Management: – Sources and Characteristics, Effects On Environment, Risk Assessment – Disposal of Hazardous Wastes – Secured Landfills, Incineration - Monitoring –

Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management

TEXT BOOKS:

1. Tchobanoglous G, Theisen H and Vigil SA 'Integrated Solid Waste Management, Engineering Principles and Management Issues' McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, 'Solid Waste Engineering' Brooks/Cole Thomson Learning Inc., 2002.

REFRENCE BOOKS:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, 'Environmental Engineering', McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner RM and Gray DH, 'Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/103/105103205/
https://archive.nptel.ac.in/courses/120/108/120108005/

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

23A02705 ELECTRIC VEHICLES
(Open Elective -IV)

Course Objectives: To make the student

- Remember and understand the differences between conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.
- Analyze various EV configurations, parameters of EV systems and Electric vehicle dynamics.
- Analyze the basic construction, operation and characteristics of fuel cells and battery charging techniques in HEV systems.
- Design and analyze the various control structures for Electric vehicle.

Course Outcomes (CO): Student will be able to

CO 1: To understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs. -L2
CO 2: Understand Various dynamics of Electric Vehicles. -L2
CO 3: To remember and understand various configurations in parameters of EV system and dynamic aspects of EV. -L1
CO 4: To analyze fuel cell technologies in EV and HEV systems. -L3
CO 5: To analyze the battery charging and controls required of EVs. -L3

UNIT I Introduction to EV Systems and Energy Sources:
Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

UNIT II EV Propulsion and Dynamics:
Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi- motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

UNIT III Fuel Cells:
Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

UNIT IV Battery Charging and Control:
Battery charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction.
Control: Introduction- Modeling of electro mechanical system- Feedback controller design approach- PI controller’s designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

UNIT V Energy Storage Technologies:
Role of Energy Storage Systems- Thermal- Mechanical-Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH - fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA

Textbooks:

1.C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001,1st Edition

2.Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press, 2017,1st Edition

Reference Books:

1.Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.

2.Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt,” Energy Storage in Power Systems” Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016,1st Edition

3.A.G.Ter-Gazarian, “Energy Storage for Power Systems”, the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.

4.Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, “Modern Elelctric, Hybrid Elelctric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2004,1st Edition

5.James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2003,2nd Edition.

Online Learning Resources:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://nptel.ac.in/syllabus/108103009

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

23A03705 TOTAL QUALITY MANAGEMENT
(Open Elective-IV).

Course objectives: Theobjectives of the courseareto	
1	Familiarize the basic concepts of Total Quality Management.
2	Expose with various quality issues in Inspection.
3	Gain Knowledge on quality control and its applications to real time..
4	Understand the extent of customer satisfaction by the application of various quality concepts.
5	Demonstrate the importance of Quality standards in Production

Course Outcomes: Onsuccessfulcompletionofthecourse, thestudentwillbeable to,		
1	Define and develop on quality Management philosophies and analyze quality costs frameworks.	L1,L3,L4
2	Understanding of the historical development of Total Quality Management (TQM), implementation, and real-world applications through case studies.	L2, L3,L6
3	Evaluate the cost of poor quality, process effectiveness and efficiency to analyze areas for improvement.	L2,L4,L5
4	Apply benchmarking and business process reengineering to improve management processes.	L3,L5,L6
5	Demonstrate the set of indications to evaluate performance excellence of an organization	L1,L2,L5

UNIT – I Introduction:
Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT - II Historical Review:
Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT – III TQM Principles:
Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures Basic Concepts, Strategy, Performance Measure Case studies.

UNIT - IV TQM Tools:
Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

UNIT – V Quality Systems:
Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Text Books:
1.Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2.Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3.Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:
1.Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.

2.Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3.Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015
4.Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

Online Learning Resources:

- https://www.youtube.com/watch?v=VD6tXadibk0
- https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
- https://blog.capterra.com/what-is-total-quality-management/
- https://nptel.ac.in/courses/110/104/110104080/
- https://onlinecourses.nptel.ac.in/noc21_mg03/preview
- https://nptel.ac.in/courses/110/104/110104085/
- https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

23A04704 **TRANSDUCERS AND SENSORS**
(Open Elective –IV)

Course Objectives:

1. To understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. To provide knowledge on flow transducers and their applications.
4. To study the working principles of pressure transducers.
5. To introduce working principle and applications of force and sound transducers.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. Gain knowledge on flow transducers and their applications.
4. Learn the working principles of pressure transducers.
5. Understand the working principle and applications of force and sound transducers.

UNIT I

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

UNIT II

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers **-** bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

UNIT III

Flow Transducers: Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT IV

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

UNIT V

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone**.**

TEXT BOOKS

1. A.K. Sawhney, “A course in Electrical and Electronics Measurements and Instrumentation”, Dhanpat Rai& Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V, “Instrumentation Devices and Systems”, TATA McGraw Hill publications, 2007.

REFERENCE BOOKS

1. Doebelin. E.O, “Measurement Systems Application and Design”,McGraw Hill International, New York, 2004.
2. Nakra B.C andChaudharyK.K , “Instrumentation Measurement and Analysis”, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

IV B.Tech I Sem

		L	T	P	C
23A05502T	**INTRODUCTION TO COMPUTER NETWORKS (Open Elective-IV)**	**3**	**0**	**0**	**3**

Course Objectives:

The course is designed to:

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Expose the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Familiarize with the applications of Internet
- Elucidate the design issues for a computer network

Course Outcomes:

After completion of the course, students will be able to:

- Identify the software and hardware components of a computer network
- Design software for a computer network
- Develop error, routing, and congestion control algorithms
- Assess critically the existing routing protocols
- Explain the functionality of each layer of a computer network
- Choose the appropriate transport protocol based on the application requirements

UNIT I:

Computer Networks and the Internet **Lecture: 8 Hrs**
What Is the Internet? Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks (Textbook 2), Reference Models, Multimedia Networks, Guided Transmission Media, Wireless Transmission (Textbook 1)

UNIT II:

The Data Link Layer, Access Networks, and LANs **Lecture: 10 Hrs**
Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1)
Introduction to the Link Layer, Error-Detection and -Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page (Packet) (Textbook 2)

UNIT III:

The Network Layer **Lecture: 8 Hrs**
Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)

UNIT IV:

The Transport Layer **Lecture: 9 Hrs**
Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT V:

The Application Layer **Lecture: 8 Hrs**
Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications, Video Streaming and Content Distribution Networks (Textbook 2)

Textbooks:

1. Andrew S. Tanenbaum, David J. Wetherall, *Computer Networks*, 6th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, *Computer Networking: A Top-Down Approach*, 6th Edition, Pearson, 2019.

Reference Books:

1. Forouzan, *Data Communications and Networking*, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akhtar, *Networks for Computer Scientists and Engineers*, Oxford Publishers, 2016.

Online Learning Resources:

1. https://nptel.ac.in/courses/106105183/25
2. https://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

IV B.Tech I Sem

		L	T	P	C
23A35501T	**INTERNET OF THINGS (Open Elective-IV)**	**3**	**0**	**0**	**3**

Course Objectives:

- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology
- Introduce some of the application areas where IoT can be applied.
- Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

Course Outcomes:
After completion of the course, students will be able to

- Understand general concepts of Internet of Things.
- Apply design concept to IoT solutions
- Analyze various M2M and IoT architectures
- Evaluate design issues in IoT applications
- Create IoT solutions using sensors, actuators and Devices

UNIT I Introduction to IoT
Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT II Prototyping IoT Objects using Microprocessor/Microcontroller
Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III IoT Architecture and Protocols
Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT IV Device Discovery and Cloud Services for IoT
Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT V UAV IoT
Introduction toUnmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Textbooks:

1. Vijay Madisetti and ArshdeepBahga, " Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis;George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “ From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 9781-4493-9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. *https://www.arduino.cc/*
2. *https://www.raspberrypi.org/*
3. *https://nptel.ac.in/courses/106105166/5*
4. *https://nptel.ac.in/courses/108108098/*4

23A32603	INTRODUCTION TO QUANTUM COMPUTING Open Elective – IV	L	T	P	C
		3	0	0	3

Course Objectives*:*

- To introduce the principles and mathematical foundations of quantum computation.
- To understand quantum gates, circuits, and computation models.
- To explore quantum algorithms and their advantages over classical ones.
- To develop the ability to simulate and write basic quantum programs.
- To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

***Course Outcomes*:**
Upon successful completion of this course, students will be able to:

- Explain the fundamental concepts of quantum mechanics used in computing.
- Construct and analyze quantum circuits using standard gates.
- Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
- Develop simple quantum programs using Qiskit or similar platforms.
- Analyze applications and challenges of quantum computing in real-world domains.

UNIT I: Fundamentals of Quantum Mechanics and Linear Algebra

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT II: Quantum Gates and Circuits

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT III: Quantum Algorithms and Complexity

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT IV: Quantum Programming and Simulation Platforms

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT V: Applications and Future of Quantum Computing

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

***Textbooks*:**

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

***Reference Books*:**

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

***Online Learning Resources*:**

1. **IBM Quantum Experience and Qiskit Tutorials**
2. **Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley**
3. edX – The Quantum Internet and Quantum Computers
4. **YouTube – Quantum Computing for the Determined by Michael Nielsen**
5. Qiskit Textbook – IBM Quantum

IV B.Tech I Sem

L	T	P	C
3	0	0	3

23A54702 FINANCIAL MATHEMATICS
(Open Elective-IV)

Course Objectives:

1. To provide mathematical foundations for financial modelling, risk assessment and asset pricing.
2. To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
3. To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
4. To equip students with computational techniques for pricing financial derivatives.

Course Outcomes:

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

COs	Statements	Blooms level
CO1	Explain fundamental financial concepts, including arbitrage, valuation, and risk.	L2 (Understand)
CO2	Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.	L3 (Apply)
CO3	Analyze mathematical techniques for pricing options and financial derivatives.	L4 (Analyze)
CO4	Evaluate interest rate models and bond pricing methodologies.	L5 (Evaluate)
CO5	Utilize computational techniques such as Monte Carlo simulations for financial modeling.	L3 (Apply)

Course Articulation Matrix:

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

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT-I: Asset Pricing and Risk Management (08)

Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT-II: Stochastic Models in Finance (08)

Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito's Lemma, Ito Integral, and Ito Isometry.

UNIT-III: Interest Rate and Credit Modelling (08)

Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT-IV: Fixed-Income Securities and Bond Pricing (08)

Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

UNIT-V: Exotic Options and Computational Finance (08)

Stochastic volatility models and the Feynman-Kac theorem.Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Textbooks:

1. Ales Cerny, *Mathematical Techniques in Finance: Tools for Incomplete Markets*, Princeton University Press.
2. S.R. Pliska, *Introduction to Mathematical Finance: Discrete-Time Models*, Cambridge University Press.

Reference Books:

1. IoannisKaratzas& Steven E. Shreve, *Methods of Mathematical Finance*, Springer, New York.
2. John C. Hull, *Options, Futures, and Other Derivatives*, Pearson.

Web References:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Coursera – Financial Engineering and Risk Management (Columbia University) https://www.coursera.org/
- National Stock Exchange (NSE) India – Financial Derivatives https://www.nseindia.com/

IV B.Tech I Sem

23A56702	**SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS (Open Elective-IV)** (Common to all branches)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To provide exposure to various kinds of sensors and actuators and their engineering applications.
2	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3	To explain the operating principles of various sensors and actuators
4	To educate the fabrication of sensors
5	To explain the required sensor and actuator for interdisciplinary application

UNIT I Introduction to Sensors and Actuators **9H**

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT II Temperature and Mechanical Sensors **9H**

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT III Optical and Acoustic Sensors **9H**

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

UNIT IV Magnetic and Electromagnetic Sensors **9H**

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT V Chemical and Radiation Sensors **9H**

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Textbooks:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview

	Course Outcomes	Blooms Level
CO1	Classify different types of Sensors and Actuators along with their characteristics	L1,L2
CO2	Summarize various types of Temperature and Mechanical sensors	L1,L2
CO3	Illustrates various types of optical and mechanical sensors	L1,L2
CO4	Analyze various types of Optical and Acoustic Sensors	L1,L2, L3
CO5	Interpret the importance of smart materials in various devices	L1,L2

Course Articulation Matrix:

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

1-Slightly, 2-Moderately, 3-Substantially.

IV B.Tech I Sem

23A51702	CHEMISTRY OF NANOMATERIALS AND APPLICATIONS (Open Elective-IV) (Common to all branches)	L	T	P	C
		3	0	0	3

Course Objectives	
1	To understand basics and characterization of nanomaterials.
2	To understand synthetic methods of nanomatrials.
3	To apply various techniques for charterization of nanomaterials.
4	To understand Studies of Nano-structured Materials
5	To enumerate the applications of advanced nanomaterials in engineering

Course Outcomes	
CO1	Classify the nanostructure materials; describe scope of nanoscience and importance technology.
CO2	Describe the top-down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about highenergy ball milling.
CO3	Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis.
CO4	Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.
CO5	Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

Mapping between Course Outcomes and Programme Outcomes

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

Unit – I

Basics and Characterization of Nanomaterials: Introduction**,** Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.

Unit – II

Synthesis of nanomaterials : Top-Down approach**,** Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, highenergy ball milling method.

Synthetic Methods**:** Bottom-Up approach**,** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-III

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT-IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT-V

Advanced Engineering Applications of Nanomaterials: Applications of Nano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

TEXT BOOKS:

1. **NANO: The Essentials:** T Pradeep, MaGraw-Hill, 2007.
2. **Textbook of Nanoscience and nanotechnology:** B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.
2. **Nanostructures &Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.

Nanomaterials

IV B.Tech I Sem

23A52704	LITERARY VIBES (Open Elective-IV)	L	T	P	C

Course Objectives	
1	To inculcate passion for aesthetic sense and reading skills
2	To encourage respecting others' experiences and creative writing
3	To explore emotions, communication skills and critical thinking
4	To educate how books serve as the reflection of history and society
5	To provide practical wisdom and duty of responding to events of the times

Course Outcomes		Blooms Level
CO1	Identify genres, literary techniques and creative uses of language in literary texts.	L1, L2
CO2	Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces	L1, L2
CO3	Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments	L3
CO4	Analyze the underlying meanings of the text by using the elements of literary texts	L4
CO5	Evaluate their own work and that of others critically	L5
CO6	Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance	L3

UNIT I: Poetry

1. Ulysses- Alfred Lord Tennyson
2. Ain't I woman?-Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT II: Drama: *Twelfth Night*- William Shakespeare

1. Shakespeare -life and works
1. Plot & sub-plot and Historical background of the play
2. Themes and Criticism
3. Style and literary elements
4. Characters and characterization

UNIT III: Short Story

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wild
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT IV: Prose: Essay and Autobiography

1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingston
3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

UNIT V: Novel: *Hard Times*- Charles Dickens

1. Charles Dickens-Life and works
2. Plot and Historical background of the novel
3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

Text Books:

1. Charles Dickens.*Hard Times.*(Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC.*William Shakespeare. Twelfth Night***.** Oxford University Press,2016.

References:

1. WJ Long.*History of English Literature***,** Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. *Essays, Short Stories and One Act Plays*, Oxford University Press .2018.

3. Dhanvel, SP. *English and Soft Skills*, Orient Blackswan,2017.
4. *New Horizon*, Pearson publications, New Delhi 2014
5. Vimala Ramarao, *Explorations Volume*-II, Prasaranga Bangalore University,2014**.**
6. Dev Neira, Anjana & Co. *Creative Writing: A Beginner's Manual.*Pearson India, 2008.

Online Resources

https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette
https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
https://www.litcharts.com/lit/twelfth-night/themes
https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

HONOURS

B.Tech (ME)– Honor's in Mechanical Engineering (R23)

23A03H01	AUTOMOTIVE THERMAL SYSTEM	L	T	P	C
		3	0	0	3

Unit I

Fundamentals and Systematic Approach to Heat Transfer Concepts

Energy, Heat & Work, First Law of Thermodynamics, Heat Engines, Refrigerators, and Heat Pumps, Second Law of Thermodynamics, Carnot Cycle, Conduction, Convection-Parallel flow on a Isothermal Plate, A cylinder in cross flow, Flow in Ducts, Free Convection, Radiation. Formulation of Thermal System Design- Requirement and Specifications, Design Variables, Constraints. Designing a workable system, Optimization methods -overview and significance

Unit II

Automotive Engine Thermal Management

Fundamentals of First & Second Law of Thermodynamics to the engine performance (Volumetric efficiency and Thermal Efficiency), heat balance equation, Fundamentals of Exergy, Energy analysis, Thermal Models and Operating Strategy- smart valve, variable speed pump, variable speed fan. Applications of Thermoelectric generators and Thermoelectric coolers, Applications of heat pipes and heat sink.

Unit III

Fundamentals of Automotive Climate Control

Psychrometric properties, Use of psychrometric chart, coefficient of performance, Refrigerants – Types of refrigerants, Properties and Selection of refrigerants, Factors affecting the air flow, Types of fans, Axial and Centrifugal fans, Load calculations, Winter air-conditioning, Two-phase flow effects in the Evaporator and Condenser, air side heat transfer on the Evaporator and Condenser, System mass effects, Simplified cabin thermal model. Convective thermal interaction-cabin air and atmosphere.

Unit IV

Fundamentals- Heat Exchangers

Functions of radiator, compressor, Functions of condenser, evaporator, expansion valve, Classification of heat exchangers – According to transfer process, Number of fluids, surface compactness, Construction features, flow arrangements, heat transfer mechanisms, Selection and design of heat exchangers based on – Types, heat transfer rate, cost, pumping power, size and materials. Coolant- function, types, and required properties. Advanced cooling system with smart valve, variable speed pump, variable speed fan, engine block, radiator, and sensors (temperature, mass flow rate and power).

Unit V

Thermal management in EV systems

Temperature sensitivity and heat generation of batteries- electro-thermal, Internal heat generation, Rate of Discharge, Battery ageing, Thermal runaway, battery heat transfer medium. Role of thermal management in power electronics and controllers, heat sink design and configuration, Application of microfluidics and nano fluids.

TEXT BOOKS:

1. Yunus A Cengel, Afshin J Ghajar, “Heat and Mass Transfer”., Tat McGraw Hill Education Private Limited, New Delhi,2018

2. W. F. Stoecker Design of Thermal Systems Third Edition, McGraw – Hill, New york, 1989

3. HoSung Lee “Thermal Design: Heat Sinks, Thermoelectrics, Heat Pipes, Compact Heat Exchangers, and Solar Cells” 2011 John Wiley & Sons, Inc

REFERENCES:

1. Jaluria, Yogesh.Design and optimization of thermal systems 2nd Edition CRC Press, Taylor & Francis Group 2018.

2. Quansheng Zhang “Automotive Air Conditioning Optimization, Control and Diagnosis” Springer International Publishing AG 2016

3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2012.

4. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003 8. “Bosch’ Automotive Handbook”, 8thEdition

Online Learning Resources:

https://nptel.ac.in/courses/112108317

https://nptel.ac.in/courses/112108149

https://nptel.ac.in/courses/112103275

https://nptel.ac.in/courses/112103276

B.Tech (ME)– Honor's in Mechanical Engineering (R23)

		L	T	P	C
23A03H02	**SIMULATION AND MODELLING OF MANUFACTURING SYSTEMS**	**3**	**0**	**0**	**3**

UNIT – I

System – ways to analyze the system – Model – types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages. Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1& 2 errors – Framing – strong law of large numbers.

UNIT – II

Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model. Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

UNIT – III

Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – weibull – normal Bernoullie – Binomial – uniform – poisson. Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – G P S S – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.

UNIT – IV

Output data analysis – Types of Simulation w.r.t output data analysis – warmup period- Welch algorithm – Approaches for Steady – State Analysis – replication – Batch means methods – comparisons

UNIT –V

Applications of Simulation – flow shop system – job shop system – M/M/1 queues with infinite and finite capacities – Simple fixed period inventory system – Newboy paper problem.

TEXT BOOKS:

1. Law, A.M. & Kelton, "Simulation Modelling and Analysis", McGraw Hill, 2nd Edition, New York, 1991.
2. Narahari and M. Vishwanathan Prentice hall England wood Cliffs, "Performance modelling of automated manufacturing systems". NJ USA 1992.

REFERENCES:

1. Carrie A. / Wiley, NY, “Simulation of Manufacturing Systems”, 1990.
2. Ross, S.M., McMillan, NY, “A Course in Simulation”, 1990. Simulation Modelling and SIMNET / Taha H.A / PH, Englewood Cliffs, NJ, 1987.
3. Banks J. & Carson J.S., PH, “Discrete Event System Simulation”, Englewood Cliffs, NJ, 1984

Online Learning Resources:

https://nptel.ac.in/courses/112102318
https://nptel.ac.in/courses/112104188
https://nptel.ac.in/courses/112104189
https://nptel.ac.in/courses/112101005

B.Tech (ME)– Honor's in Mechanical Engineering (R23)

		L	T	P	C
23A03H03	**SUPPLY CHAIN MANAGEMENT**	**3**	**0**	**0**	**3**

UNIT-1

Introduction to Supply Chain Management

Supply chain - objectives - importance - decision phases - process view -competitive and supply chain strategies - achieving strategic fit – supply chain drivers - obstacles – framework - facilities - inventory-transportation-information-sourcing-pricing.

UNIT-2

Designing the distribution network

Role of distribution - factors influencing distribution - design options - e-business and its impact – distribution networks in practice –network design in the supply chain - role of network -factors affecting the network design decisions modeling for supply chain. Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs tailored transportation.

UNIT-3

Supply Chain Analysis.

Sourcing - In-house or Outsource - 3rd and 4th PLs - supplier scoring and assessment, selection - design collaboration - Procurement process - Sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

UNIT-4

Dimensions of Logistics

A macro and micro dimension - logistics interfaces with other areas - approach to analyzing logistics systems - logistics and systems analysis - techniques of logistics system analysis - factors affecting the cost and importance of logistics. Demand Management and Customer Service Outbound to customer logistics systems - Demand Management –Traditional Forecasting - CPFRP - customer service - expected cost of stock outs - channels of distribution.

UNIT-5

Recent Trends in Supply Chain Management-Introduction, New Developments in Supply Chain Management, Outsourcing Supply Chain Operations, Co-Maker ship, The Role of E-Commerce in Supply Chain Management, Green Supply Chain Management, Distribution Resource Planning, World Class Supply Chain Management

TEXT BOOKS:

1. Sunil Chopra and Peter Meindl, Supply Chain Management – "Strategy, Planning and Operation", 3rd Edition, Pearson/PHI, 2007.
2. Supply Chain Management by Janat Shah Pearson Publication 2008.

REFERENCE BOOKS:

1. A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, Cengage Learning, 1/e
2. Donald J Bowersox, Dand J Closs, M Bixby Coluper, “Supply Chain Logistics Management”, 2nd edition, TMH, 2008.
3. Wisner, Keong Leong and Keah-Choon Tan, “Principles of Supply Chain Management A Balanced Approach”, Cengage Learning, 1/e
4. David Simchi-Levi et al, “Designing and Managing the Supply Chain” – Concepts.

Online Learning Resources:

https://nptel.ac.in/courses/112103774
https://nptel.ac.in/courses/112107219
https://nptel.ac.in/courses/112101005

B.Tech (ME)– Honor's in Mechanical Engineering (R23)

		L	T	P	C
23A03H04	**ADVANCED MECHANISM DESIGN**	**3**	**0**	**0**	**3**

UNIT– I

Introduction – review of fundamentals of kinematics - analysis and synthesis – terminology, definitions and assumptions – planar, spherical and spatial mechanisms‟ mobility – classification of mechanisms – kinematic Inversion – Grashoff`s law Position and displacement – complex algebra solutions of planar vector equations – coupler curve generation velocity – analytical methods - vector method – complex algebra methods – Freudenstein‟s theorem

UNIT– II

Planar complex mechanisms - kinematic analysis - low degree complexity and high degree complexity, Hall and Ault`s auxiliary point method – Goodman‟s indirect method for low degree of complexity mechanisms Acceleration – analytical methods – Chase solution - Instant centre of acceleration. Euler-Savory equation - Bobillier construction

UNIT – III

Synthesis of mechanisms: Type, number and dimensional synthesis – function generation – two position synthesis of slider crank and crankrocker mechanisms with optimum transmission angle – three position synthesis – structural error – Chebychev spacing - Cognate linkages – Robert-Chebychev theorem – Block‟s method of synthesis, Freudenstein‟s equation

UNIT – IV

Static force analysis of planar mechanism – static force analysis of planar mechanism with friction – method of virtual work Dynamic force analysis of planar mechanisms - Combined static and inertia force analysis

UNIT – V

Kinematic analysis of spatial revolute-Spherical-Spherical-Revolute mechanism – Denavit-Hartenberg parameters – forward and inverse kinematics of robotic manipulators

TEXT BOOK:

1. Amitabh Ghosh and Ashok Kumar Mallik, "Theory of Mechanisms and Machines,",3e,EWP, 1999
2. Arthur G. Erdman and G.N. Sandor, "Advanced Mechanism Design: Analysis and Synthesis", Vol. II, PHI, 1984.

REFERENCES:

1. Shighley Joseph Edwards and Uicker John Joseph, "Theory of Machines and Mechanism", 2e, McGraw Hill,1985.
2. Arthur G. Erdman and G.N. Sandor, "Advanced Mechanism Design: Analysis and Synthesis", Vol. I, PHI, 1984.

Online Learning Resources:

https://nptel.ac.in/courses/112101005
https://nptel.ac.in/courses/112104230
https://nptel.ac.in/courses/112107258

B.Tech (ME)– Honor's in Mechanical Engineering (R23)

		L	T	P	C
23A03H05	**BIOMECHANICS**	**3**	**0**	**0**	**3**

Unit I

Introductory Mechanics – Statics and Dynamics – Basic Principles. The human body as a biomechanical system – basic terminologies.

Unit II

Kinematics of muscles and joints - free-body diagrams and equilibrium, forces and stresses in joints Biomechanical analysis of joints of upper limb - Shoulder, Elbow, wrist, hand and fingers.

Unit III

Upper limb as a mechanical system – analysis of reaching as movement of a multi-link serial chain – forward kinematics, analysis of fingertip forces as a parallel manipulator

Unit IV

Biomechanical analysis of joints – Spine, Hip, Knee, Ankle. Introduction to Postural stability and Gait analysis. Gait analysis in health and disease - basics. Mechanics of Hard Tissues - Definition of Stress and Strain, Deformation Mechanics, structure and mechanical properties of bone - cortical and cancellous bones, Wolff's law of bone remodeling.

Unit V

Soft Tissues - Structure, functions, material properties – tendon function, elasticity in a tendon, models of non-linear elasticity in a tendon – physiological and non-physiological regimes, Davis' law of soft tissue remodeling. Visco-elastic properties of soft tissues, Models of visco-elasticity: Maxwell & Voight models. Basic Biofluid mechanics - Flow properties of blood in the intact human cardiovascular system.

TEXT BOOKS

1.David A. Winter, Biomechanics and Motor Control of Human Movement .
2.Margareta Nordin and Victor H. Frankel, Basic Biomechanics of the Musculoskeletal System.

REFERENCE BOOKS

1. Francisco Valero-Cuevas, Fundamentals of Neuromechanics.
2. Susan Hall, Basic Biomechanics.
3. Irving Hermann, Physics of Human Body.

Online Learning Resources:

https://nptel.ac.in/courses/112105305

https://nptel.ac.in/courses/112104029