GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)

NELLORE–524317 (A.P) INDIA

B.TECH. (Regular-Full time)
MECHANICAL ENGINEERING
COURSE STRUCTURE AND SYLLABUS
UNDER B Tech ME- RG 23 REGULATIONS

Department of Mechanical Engineering

Vision

To evolve as a prospective learning center producing competent Mechanical Engineers to full fill the ever-changing needs of society and industry demands.

Mission

M1. To Impart comprehensive knowledge and experience in Mechanical Engineering domain through the effective implementation of Teaching-Learning methodologies

M2. To promote the culture of Interdisciplinary learning and facilitate Industrial training to resolve global Engineering issues

M3. To Impart training on modern drafting and analysis software sharpening computational capabilities and promoting higher studies

M4. To Initiate Industry-Institute Interface facilitating skill enhancement keeping pace with emerging industrial trends by Infusing ethical values

Program Educational Outcomes

PE01. Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PE02. Pursue successful professional career in industry, academia or research.

PE03. Engage in continuous learning to keep abreast with emerging technologies with the sense of professional ethics.

PE04. Contribute in multi-disciplinary teams through effective interpersonal skills

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Utilize the knowledge of materials and manufacturing principles to plan, design and monitor the production operations of an Industry.

PSO2: Employ the governing laws of thermodynamics, heat transfer and refrigeration & air-conditioning to design and develop thermo-fluid system.

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E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

B.Tech. I Year I Semester (Theory-5, Lab-4, MC-1)							
S.No.	**category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	BS	23A0003T	Engineering Physics	3	0	0	3
2.	BS	23A0001T	Linear Algebra & Calculus	3	0	0	3
3.	ES	23A0201T	Basic Electrical & Electronics Engineering	3	0	0	3
4.	ES	23A0301T	Engineering Graphics	1	0	4	3
5.	ES	23A0501T	Introduction to Programming	3	0	0	3
6.	ES	23A0503P	IT Workshop	0	0	2	1
7.	BS	23A0006P	Engineering Physics Lab	0	0	2	1
8.	ES	23A0202P	Electrical & Electronics Engineering workshop	0	0	3	1.5
9.	ES	23A0502P	Computer Programming Lab	0	0	3	1.5
10.	MC	23ANSG01P	NSS / NCC / Scouts & Guides / Community Service	-	-	1	0.5
			Total=	13	0	15	20.5

Category	Credits
Basic Sciences (BS)	07
Engineering Sciences (ES)	13
Mandatory Course (MC)	0.5
Total	20.5

Member secretary

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B.Tech. I Year II Semester (Theory-5, Lab-4, MC-1)							
S.No.	category	Course Code	Course Name	L	T	P	Credits
1.	HM	23A0009T	Communicative English	2	0	0	2
2.	BS	23A0005T	Chemistry	3	0	0	3
3.	BS	23A0002T	Differential Equations and Vector calculus	3	0	0	3
4.	ES	23A0101T	Basic Civil & Mechanical Engineering	3	0	0	3
5.	ES	23A0303T	Engineering Mechanics	3	0	0	3
6.	HM	23A0010P	Communicative English Lab	0	0	2	1
7.	BS	23A0008P	Chemistry Lab	0	0	3	1
8.	ES	23A0302P	Engineering Workshop	0	0	3	1.5
9.	ES	23A0304P	Engineering Mechanics Lab	0	0	3	1.5
10.	MC	23AYG01P	Health and Wellness, Yoga and Sports	-	-	1	0.5
			Total	14	0	11	19.5

Category	Credits
Humanities and Social Science including Management (HM)	03
Basic Sciences (BS)	07
Engineering Science (ES)	09
Mandatory Courses (MC)	0.5
Total	19.5

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B.Tech. II Year I Semester (Theory-5, Lab-3, SEC-1, MC-1)

S.No	Category	Course Code	Course Name	L	T	P	Credits
1.	BS	23A0013T	Transforms and Numerical Methods	3	0	0	3
2.	HM	23A0021T	Universal Human Values–Understanding Harmony & Ethical human conduct	2	1	0	3
3.	PC	23A0305T	Thermodynamics	2	0	0	2
4.	PC	23A0306T	Mechanics of Solids	3	0	0	3
5.	PC	23A0307T	Material Science and Metallurgy	3	0	0	3
6.	PC	23A0308P	Mechanics of Solids and Materials Science Lab	0	0	3	1.5
7.	PC	23A0309P	Computer-aided Machine Drawing	0	0	3	1.5
8.	ES	23A0510P	Python programming Lab	0	0	2	2
9.	SEC	23A0406P	Embedded Systems and IoT	0	1	2	1
10.	MC	23A0109T	Environmental Science	2	0	0	-
			Total	**15**	**2**	**10**	**20**

Category	Credits
Humanities and Social Science including Management (HM)	03
Basic Sciences (BS)	03
Engineering Sciences (ES)	02
Professional Core (PC)	11
Skill Enhancement Courses (SEC)	01
Mandatory Courses (MC)	00
Total	20

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B.Tech. II Year II Semester (Theory-5, Lab-3, SEC-1, MC-1)

No.	Category	Course Code	Course Name	L	T	P	Credits
1.	HM	23A0027T	Industrial Management	2	0	0	2
2.	BS	23A0016T	Complex Variables, Probability and Statistics	3	0	0	3
3.	PC	23A0310T	Manufacturing processes	3	0	0	3
4.	PC	23A0311T	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5.	PC	23A0312T	Design of Machine Members	3	0	0	3
6.	PC	23A0313P	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7.	PC	23A0314P	Manufacturing processes Lab	0	0	3	1.5
8.	HM	23A0026P	Soft Skills	0	1	2	2
9.	PC	23A0413T	Design Thinking & Innovation	1	0	2	2
			Total	**15**	**1**	**10**	**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation							

Category	Credits
Humanities and Social Science including Management(HM)	04
Basic Science (BS)	03
Professional Core (PC)	14
Total	21

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B.Tech. III Year I Semester (Theory-6, Lab-3, SE-1, MC-1)							
S.No.	category	Course Code	Course Name	L	T	P	Credits
1.	PC	23A0315T	Machining Process	3	0	0	3
2.	PC	23A0316T	Thermal Engineering	3	0	0	3
3.	PC	23A0317T	Metrology and Measurements	3	0	0	3
4.	PC	23A0522T	Introduction to Quantity Technologies and its Application	3	0	0	3
5.	-	-	**Professional Elective-I**	3	0	0	3
	PE	23A0318Ta	1. Tool Design				
		23A0318Tb	2. Automobile Engineering				
		23A0318Tc	3. Mechanical behaviour of Materials				
		23A0318Td	4. Work study and Ergonomics				
		23A0318Te	5. Nano Technology				
6.	OE	--	**Open Elective-I**	3	0	0	3
7.	PC	23A0320P	Thermal Engineering Lab	0	0	3	1.5
8.	PC	23A0321P	Dynamics lab	0	0	3	1.5
9.	SEC	23A0322P	**Skill Enhancement course** Machine Tools & Metrology lab	0	1	2	2
10.	ES	23A0420P	Tinkering Lab	0	0	2	1
11.	PR	23A0323	**Evaluation of Community Service Internship** Community Service Internship /Project	-	-	-	2
			Total	18	1	10	26

Category	**Credits**
Professional Core (PC)	15
Professional Elective (PE)	03
Open Elective Course (OE)	03
Internships & Project work (PR)	02
Skill Enhancement Course (SEC)	02
Engineering Science (ES)	01
Total	26

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23A0148T	Green Buildings	CIVIL
2.	23A0149T	Construction Technology and Management	
3.	23A0222T	Electrical Safety Practices and Standards	EEE
4.	23A0442T	Electronic Circuits	ECE
5.	23A0545T	Java Programming	CSE & Allied
6.	23A0546T	Fundamentals of Artificial Intelligence	
7.	23A0547T	Quantum Technologies and Applications	
8.	23A0027T	Mathematics for Machine Learning and AI	Mathematics
9.	23A0034T	Materials Characterization Techniques	Physics
10.	23A0040T	Chemistry of Energy Systems	Chemistry
11.	23A0044T	English for Competitive Examinations	Science and Humanities
12.	23A0051T	Entrepreneurship and New Venture Creation	

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B.Tech. III Year II Semester (Theory-6, Lab-2, SEC-1, MC-1)

S.No.	Course Code	category	Course Name	L	T	P	Credits
1.	PC	23A0324T	Heat Transfer	3	0	0	3
2.	PC	23A0325T	CAD/CAM	3	0	0	3
3.	PC	23A0326T	Theory of machines	2	1	0	3
4.	PE	-	**Professional Elective-II**	3	0	0	3
		23A0327Ta	1. Engineering Fracture Mechanics				
		23A0327Tb	2. Introduction of Turbo Machinery				
		23A0327Tc	3. Control Systems				
		23A0327Td	4. Operations Research				
		23A0327Te	5. Smart Materials				
5.	PE	--	**Professional Elective-III**	3	0	0	3
		23A0328Ta	1. Applications of Computational Fluid dynamics				
		23A0328Tb	2. Industrial Safety				
		23A0328Tc	3. Design of Automobile Transmission Systems				
		23A0328Td	4.Mechanics & Manufacturing of Composite Materials				
		23A0328Te	5.Introduction to hybrid and electric vehicles				
6.	OE	---	**Open Elective-II**	3	0	0	3
7.	PC	23A0329P	Heat Transfer Lab	0	0	3	1.5
8.	PC	23A0330P	CAD/CAM Lab	0	0	3	1.5
9.	SEC	23A0331	**Skill Enhancement course** 3 D Printing Lab	0	1	2	2
10	MC	23A0053T	**Audit Course** Technical paper writing and IPR	2	0	0	0
11	MC	23A0332	**Workshop**	0	0	0	0
			Total	19	2	08	23
Mandatory Industry Internship of 6-8 weeks duration during summer vacation							

Category	**Credits**
Professional Core (PC)	12
Professional Elective (PE)	06
Open Elective (OE)	03
Skill Enhancement Course (SEC)	02
Mandatory course (MC)	00
Total	23

Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23A0150T	Disaster Management	CIVIL
2.	23A0151T	Sustainability In Engineering Practices	
3.	23A0232T	Renewable Energy Sources	EEE
4.	23A0443T	Digital Electronics	ECE
5.	23A0548T	Fundamentals of Operating system	CSE & Allied
6.	23A0529T	Machine Learning	
7.	23A0030T	Optimization Techniques	Mathematics
8.	23A0029T	Mathematical Foundation of Quantum Technologies	
9.	23A0035T	Physics of Electronic Materials and Devices	Physics
10.	23A0041T	Chemistry of Polymers and Applications	Chemistry
11.	23A0045T	Academic Writing and Public Speaking	Science and Humanities

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B.Tech. IV Year I Semester (Theory-6, Lab-2, SEC-1, MC-1)

S.No	category	Course Code	Course Name	L	T	P	Credits
1.	PC	23A0549T	AI & ML for Mechanical Engineering	3	0	0	3
2.	HM	----	**Management Course- II**	2	0	0	2
		23A0049T	1. Business Ethics and Corporate Governance				
		23A0050T	2. E-Business				
		23A0048T	3. Management Science				
3.	PE	23A0333T	**Professional Elective-IV**	3	0	0	3
		23A0333Ta	1. Mechanical Vibrations				
		23A0333Tb	2. Finite Element Methods				
		23A0333Tc	3. Refrigeration & Air Conditioning				
		23A0333Td	4. Mechatronics & MEMS				
		23A0333Te	5. Power Plant Engineering				
4.	PE	23A0334T	**Professional Elective-V**	3	0	0	3
		23A0334Ta	1. Non Conventional Energy Sources				
		23A0334Tb	2. Automation & Robotics				
		23A0334Tc	3. Non-Destructive Testing				
		23A0334Td	4. Total Quality Management				
		23A0334Te	5. Smart Manufacturing				
5.	OE	---	**Open Elective-III**	3	0	0	3
6.	OE	---	**Open Elective-IV**	3	0	0	3
8.	SEC	23A0336	**Skill Enhancement Course** Introduction to Drone Technology	0	1	2	2
9.	MC	23A0054T	**Audit Course** Gender Sensitization	2	0	0	0
10.	PR	23A0337	**Internship** Evaluation of Industry Internship	0	0	0	2
			Total	18	1	04	21

Category	**Credits**
Humanities & Social Sciences including Management (HM)	02
Professional Core (PC)	03
Professional Elective (PE)	06
Open Elective (OE)	06
Mandatory Courses (MC)	00
Skill Enhancement Course (SEC)	02
Internships & Project work (PR)	02
Total	21

Open Elective – III

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23A0152T	Building Materials and Services	CIVIL
2.	23A0121T	Environmental Impact Assessment	
3.	23A0241T	Smart Grid Technologies	EEE
4.	23A0416T	Microprocessors and Microcontrollers	ECE
5.	23A0512T	Data Base Management Systems	CSE & Allied
6.	23A0532Tb	Cyber Security	
7.	23A0031T	Wavelet transforms and its applications	Mathematics
8.	23A0036T	Smart Materials and Devices	Physics
9.	23A0037T	Introduction to Quantum Mechanics	
10.	23A0042T	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
11.	23A0046T	Employability Skills	Science and Humanities

Open Elective – IV

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23A0153T	Geo-Spatial Technologies	CIVIL
2.	23A0154T	Solid Waste Management	
3.	23A0242T	Electric Vehicles	EEE
4.	23A0444T	Transducers and Sensors	ECE
5.	23A0520T	Computer Networks & Internet Protocols	CSE & Allied
6.	23A0450T	Internet of Things	
7.	23A3315a	Introduction to Quantum Computing	
8.	23A0032T	Financial Mathematics	Mathematics
9.	23A0038T	Sensors and Actuators for Engineering Applications	Physics
10.	23A0043T	Chemistry Of Nanomaterials and Applications	Chemistry
11.	23A0047T	Literary Vibes	Science and Humanities

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B.Tech. IV Year II Semester

Semester–VIII							
S.No	category	Course Code	Course Name	L	T	P	Credits
1.	PR	23A0338	Internship	-	-	-	4
	PR	23A0339	Project	-	-	-	8
			Total	0	0	0	12

Category	**Credits**
Internship and Project Work (PR)	12
Total	12

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PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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B.Tech. I Year I Semester (Theory-5, Lab-4, MC-1)

S.No.	category	Course Code	Course Name	L	T	P	Credits
1.	BS	23A0003T	Engineering Physics	3	0	0	3
2.	BS	23A0001T	Linear Algebra & Calculus	3	0	0	3
3.	ES	23A0201T	Basic Electrical & Electronics Engineering	3	0	0	3
4.	ES	23A0301T	Engineering Graphics	1	0	4	3
5.	ES	23A0501T	Introduction to Programming	3	0	0	3
6.	ES	23A0503P	IT Workshop	0	0	2	1
7.	BS	23A0006P	Engineering Physics Lab	0	0	2	1
8.	ES	23A0202P	Electrical & Electronics Engineering workshop	0	0	3	1.5
9.	ES	23A0502P	Computer Programming Lab	0	0	3	1.5
10.	MC	23ANSG01P	NSS / NCC / Scouts & Guides / Community Service	-	-	1	0.5
			Total=	13	0	15	20.5

Category	Credits
Basic Sciences (BS)	07
Engineering Sciences (ES)	13
Mandatory Course (MC)	0.5
Total	20.5

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B.Tech. I Year I Semester

ENGINEERING PHYSICS

(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0003T	3: 0: 0	3	CIE:30 SEE:70	3 Hours	BS

Prerequisite: Student should know about fundamental and basic principles in physics

Course Objectives:

To bridge the gap between the Physics in school at 10+2 level and UG level engineering coursesby 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.

Syllabus		Total Hours:48
Unit- I	**Wave Optics**	**10**

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

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due tosingle 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 andDouble refraction - Nicol's Prism -Half wave and Quarter wave plates

Unit- II	**Crystallography And X-Ray Diffraction**	**8**

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**	**10**

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 dilectric 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**	**10**

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	10

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 effectand its applications.
Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – High Tc superconductors– Applications of superconductors

Course Outcomes(CO):

On completion of this course, student will be able to

- Analyze the intensity variation of light due to polarization, interference anddiffraction.
- Familiarize with the basics of crystals and their structures.
- Summarize various types of polarization of dielectrics and classify the magneticmaterials.
- Apply fundamentals of quantum mechanics to band theory of solids.
- Identify the type of semiconductor using Hall effect.

Text Books:

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).
3. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers

Reference Books:

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

Web References:

- https://www.textbooks.com/Catalog/MG5/Applied-Physics.php
- https://edurev.in/courses/9596_Electromagnetic-Theory-Notes--Videos--MCQs--PPTs
- https://libguides.ntu.edu.sg/c.php?g=867756&p=6226561
- https://bookauthority.org/books/best-applied-physics-books
- https://www.electronicsforu.com/resources/16-free-ebooks-on-material-science/2

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B.Tech. I Year I Semester

LINEAR ALGEBRA & CALCULUS
(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0001T	3:0:0	3	CIE:30 SEE:70	3Hours	BS

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.

Syllabus		Total Hours:48
Unit-I	**Matrices**	**9Hrs**

Rank of a matrix by echelon 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 - Gauss elimination method, Iteration Methods: Gauss- Jacobi and Gauss Seidel Iteration Methods. Applications: Finding the current in electrical circuits**.**

Unit-II	**Eigenvalues, Eigenvectors and Orthogonal Transformation**	**9Hrs**

Eigenvalues, 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**	**9Hrs**

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

Unit-IV	**Partial differentiation and Applications (Multi variable calculus)**	**9Hrs**

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, 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)**	**9Hrs**

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

Course Outcomes(CO):

On completion of this course, student will be able to

- Solving systems of linear equations that is needed by engineers for practical applications.
- Find the eigen values and eigen vectors to facilitate the calculation of matrix characteristics.
- Utilize mean value theorems to real life problems.

- Apply the technique of partial differentiation to find the Jacobian and the extreme values of functions of several variables.
- Apply the techniques of multiple integrals to find the areas and volumes.

Text Books:

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, R. K. Jain and S. R. K. Iyengar, Alpha ScienceInternational Ltd., 2021 5th Edition(9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th edition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)
6. Engineering Mathematics III by N.P. Bali, Dr. K.L. Sai Prasad, University Science Press.
7. Engineering Mathematics I by T.K.V. Iyengar, B.Krishna Gandhi,, S. Chand Publications, 2019 Edition.
8. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N.Prasad, S. Chand Publications.
9. Higher Engineering Mathematics, B. V. Ramana, McGraw Hill Education, 2017.

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B.Tech. I Year I Semester

BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to All branches of Engineering)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0201T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**ES**

Course Objectives:

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

- **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.**

Syllabus PART A: BASIC ELECTRICAL ENGINEERING		Total Hours: 48Hrs
Unit-I	**DC & AC Circuits**	**10Hrs**

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**	**8Hrs**

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**	**6Hrs**

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.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.

- 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.
- 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.
- Analyze different electrical circuits, performance of machines and measuring instruments.
- Evaluate different circuit configurations, Machine performance and Power systems operation.

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.

WebResources:

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

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

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

- 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.

Syllabus		
Unit-I	**SEMICONDUCTOR DEVICES**	**6Hrs**
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**	**10Hrs**
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**	**8Hrs**
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).		

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Apply the concept of science and mathematics to understand the working of diodes, transistors, and their applications.

- Explain the characteristics of diodes and transistors.
- Familiarize with the number systems, codes, Boolean algebra and logic gates.
- Understand the working mechanism of different combinational, sequential circuits and their role in the digital systems

Textbooks:

1. R.L.Boylestad&LouisNashlesky,ElectronicDevices&CircuitTheory,PearsonEducation,2021.
2. R. P.Jain,ModernDigitalElectronics, 4th Edition,TataMcGrawHill, 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

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B.Tech. I Year I Semester

ENGINEERING GRAPHICS (Common to All branches of Engineering)					
Course Code	**L T P/D**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0301T	**1 0 4**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**ES**

Course Objectives:

The students completing the course are expected to:

- Understand the basic principles and conventions of engineering drawing, use engineering instruments and draw engineering curves.
- Use orthographic projections and make the students draw the projections of linesand planes inclined to both the planes.
- Draw the projections of the solids in different positions with respect to the referenceplanes.
- Understand the importance of sectioning and concept of development of surfaces.
- Represent and convert isometric views to orthographic views and vice versa.

Unit-I		**10Hrs**

Introduction:

Lines,Lettering and Dimensioning,Geometrical Constructions andConstructing 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		**12Hrs**

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 onereference plane and inclined to the other reference plane; plane inclined to both the reference planes

Unit -III		**12Hrs**

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 other and axes inclined to both the reference planes

UNIT IV		**12Hrs**
Sections of Solids: Perpendicular and inclined section planes, Sectional views and Trueshape of section, Sections of solids in simple position only. Development of Surfaces: Methods of Development: Parallel line development and radialline development. Development of a cube, prism, cylinder, pyramid and cone.		
UNIT V		**12Hrs**
Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views. Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).		

Course Outcomes(CO):

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

- Understand the principles of engineering drawing, including engineering curves,scales, orthographic and isometric projections.
- Draw and interpret orthographic projections of points, lines, planes and solids infront, top and side views.
- Understand and apply concepts of sectional views to represent details of solids insimple positions.
- Gain a clear understanding of the principles behind development of surfaces and to understand how to unfold basic geometric shapes into flat patterns.
- Develop the ability to draw isometric views and orthographic views and should beable to convert isometric views to orthographic views and vice versa.

Textbooks:

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, TataMcGraw Hill, 2017.

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B.Tech. I Year I Semester

INTRODUCTION TO PROGRAMMING
(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0501T	3:0:0	3	CIE:30 SEE:70	3 Hours	ES

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

Syllabus		Total Hours:48
Unit-I	**Introduction to Programming and Problem Solvir**	**10Hrs**

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**	**8Hrs**

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

Unit-III	**Arrays and Strings**	**10Hrs**

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

Unit-IV	**Pointers & User Defined Data types**	**10Hrs**

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**	**10Hrs**

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, command line arguments, Preprocessor directives, Basics of File Handling.

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

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand basics of computers, the concept of algorithm and algorithmic thinking.
- Analyse a problem and develop an algorithm to solve it.
- Implement various algorithms using the C programming language.

- Understand more advanced features of C language.
- Develop problem-solving skills and the ability to debug and optimize the code.

Text Books:

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 Problem Solving Approach, Forouzan, Gilberg,Prasad, CENGAGE, 3rd edition

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B.Tech. I Year I Semester

IT WORKSHOP
(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0503P	0: 0: 2	1	CIE:30 SEE:70	3 Hours	ES

Course Objectives:

This course will enable students to:
- 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.

Syllabus	Total Hours:32

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 is no 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.

Task 5: Install any anti-virus software on your computer

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?'"

Course Outcomes(CO):

On completion of this course, student will be able to

- Perform Hardware troubleshooting.
- Understand Hardware components and inter dependencies.
- Safeguard computer systems from viruses/worms.
- Document/ Presentation preparation.
- Perform calculations using spreadsheets

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

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B.Tech. I Year I Semester

ENGINEERING PHYSICS LAB

(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0006P	0: 0: 2	1	CIE:30 SEE:70	3 Hours	BS

Prerequisite: Student should know about fundamental and basic principles in physics

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.

List of Experiments	Total Hours:32

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 wavelength of Laser light using diffraction grating.
5. Estimation of Planck's constant using photoelectric effect.
6. Magnetic field along the axis of a current carrying circular coil by Stewart Gee'sMethod.
7. Determination of dielectric constant using charging and discharging method.
8. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
9. Determination of magnetic susceptibility by Kundt's tube method.
10. Determination of the resistivity of semiconductors by four probe methods.
11. Determination of energy gap of a semiconductor using p-n junction diode.
12. Determination of Hall voltage and Hall coefficient of a given semiconductor usingHall Effect.
13. Determination of temperature coefficients of a thermistor.
14. Determination of rigidity modulus of the material of the given wire using Torsionalpendulum.
15. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
16. Determination of Frequency of electrically maintained tuning fork by Melde'sexperiment.
17. Sonometer : Verification of laws of stretched string.
18. Determination of acceleration due to gravity and radius of Gyration by using acompound pendulum.

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

Course Outcomes(CO):

On completion of this course, student will be able to

- Operate optical instruments like travelling microscope and spectrometer.
- Estimate dielectric constant of capacitor and magnetic induction of current carrying coil
- Identify the type of semiconductor and calculate band gap of it.
- Evaluate different modulus of materials.
- Measure the frequency of tuning fork and verify the laws in Sonometer.

Reference Books:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. ChandPublishers, 2017.

Web References:

1. *www.vlab.co.in*

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B.Tech. I Year I Semester

ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP
(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0202P	0: 0: 3	1.5	CIE:30 SEE:70	3 Hours	ES

Course Objectives:

This course will enable students to:
- To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations

List of Experiments	Total Hours:32

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second **order system**
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using Zbus matrix
11. Design of virtual PMU
12. Wide area control of Two area **Kundur system**

(Any 10 experiments from the above list)

Course Outcomes(CO):

On completion of this course, student will be able to
- Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
- 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.
- Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
- Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
- Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

Activities:
- 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.
- 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
- 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

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.

Course Outcomes (CO):

At the end of the course, the student will be able to

- Identify & testing of various electronic components.
- Understand the usage of electronic measuring instruments.
- Plot and discuss the characteristics of various electron devices.
- Explain the operation of a digital circuit.

Reference Books:

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.

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B.Tech. I Year I Semester

COMPUTER PROGRAMMING LAB (Common to all Branches of Engineering)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0502P	**0: 0: 3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**ES**
Course Objectives:					
The course aims to give students hands – on experience and train them on the concepts of the C-programming language.					
Syllabus				**Total Hours:32**	

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 2: 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 relation a land logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5**: Problemsinvolving if-then-elsestructures.**

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 andfor 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

1. Find the factorial of given number using any loop.
2. Find the given number is a prime or not.
3. Compute sine and cos series
4. Checking a number palindrome
5. 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

WEEK 9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an arrayand 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

Course Outcomes(CO):

On completion of this course, student will be able to

- Read, understand, and trace the execution of programs written in C language.
- Select the right control structure for solving the problem.

- Develop C programs which utilize memory efficiently using programming constructs like pointers.
- Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.

Text Books:

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

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B.TECH. (Regular-Full time)
MECHANICAL ENGINEERING
COURSE STRUCTURE AND SYLLABUS
UNDER B Tech ME- RG 23 REGULATIONS

I YEAR II SEMESTER

Department of Mechanical Engineering

Vision

To evolve as a prospective learning center producing competent Mechanical Engineers to full fill the ever-changing needs of society and industry demands.

Mission

M1. To Impart comprehensive knowledge and experience in Mechanical Engineering domain through the effective implementation of Teaching-Learning methodologies

M2. To promote the culture of Interdisciplinary learning and facilitate Industrial training to resolve global Engineering issues

M3. To Impart training on modern drafting and analysis software sharpening computational capabilities and promoting higher studies

M4. To Initiate Industry-Institute Interface facilitating skill enhancement keeping pace with emerging industrial trends by Infusing ethical values

Program Educational Outcomes

PE01. Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PE02. Pursue successful professional career in industry, academia or research.

PE03. Engage in continuous learning to keep abreast with emerging technologies with the sense of professional ethics.

PE04. Contribute in multi-disciplinary teams through effective interpersonal skills

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Utilize the knowledge of materials and manufacturing principles to plan, design and monitor the production operations of an Industry..

PSO2: Employ the governing laws of thermodynamics, heat transfer and refrigeration & air-conditioning to design and develop thermo-fluid system.

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B.Tech. I Year II Semester (Theory-5, Lab-4, MC-1)

S.No.	category	Course Code	Course Name	L	T	P	Credits
1.	HM	23A0009T	Communicative English	2	0	0	2
2.	BS	23A0005T	Chemistry	3	0	0	3
3.	BS	23A0002T	Differential Equations and Vector calculus	3	0	0	3
4.	ES	23A0101T	Basic Civil & Mechanical Engineering	3	0	0	3
5.	ES	23A0303T	Engineering Mechanics	3	0	0	3
6.	HM	23A0010P	Communicative English Lab	0	0	2	1
7.	BS	23A0008P	Chemistry Lab	0	0	3	1
8.	ES	23A0302P	Engineering Workshop	0	0	3	1.5
9.	ES	23A0304P	Engineering Mechanics Lab	0	0	3	1.5
10.	MC	23AYG01P	Health and Wellness, Yoga and Sports	-	-	1	0.5
			Total	14	0	11	19.5

Category	Credits
Humanities and Social Science including Management (HM)	03
Basic Sciences (BS)	07
Engineering Science (ES)	09
Mandatory Courses (MC)	0.5
Total	19.5

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B.Tech. I Year II Semester

COMMUNICATIVE ENGLISH
(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
230009T	2: 0: 0	2	CIE:30 SEE:70	3 Hours	HM

Course Objectives:

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Help improve speaking skills motivating the learners to participate in activities such as role plays, discussions and structured talks/oral presentations
- Focus on appropriate reading skills for comprehension of various academic texts and authentic materials
- Impart effective strategies for good writing skills in summarizing, writing well organized essays, drafting formal letters and designing well structured reports
- Broaden the knowledge base of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Syllabus		Total Hours:32
Unit – I	**HUMAN VALUES:** Gift of Magi **(Short Story)**	8 Hrs

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	**The Brook by Alfred Tennyson (Poem)**	7Hrs

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structured 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	**BIOGRAPHY: Elon Musk**	6 Hrs

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**,**
Vocabulary: Compound words, Collocations

Unit - IV	INSPIRATION: The Toys of Peace -Saki	6 Hrs

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 texts to convey 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	MOTIVATION: The Power of Intrapersonal Communication (An Essay)	5 Hrs

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 for 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

Course Outcomes(CO):

On completion of this course, student will be able to

- The learner will be able to speak and write grammatically accurate sentences through applications of principles of English grammar
- The learner will enhance vocabulary skills to build strong language skills.
- The learner acquires the ability to understand the academic text from multiple dimensions employing ethical and logical reasoning based on accurate comprehension
- The learner gains evaluation potential by employing standard reading & listening strategies to grasp the core essence and spirit of the text
- The learner will gain mastery on speaking & writing skills through the application of relevant guidelines, through consistent practice of functional English expression.

Text Books:

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 References:

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

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B.Tech. I Year II Semester

CHEMISTRY (Common to all Branches of Engineering)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0005T	**3:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**BS**

Course Objectives:

- To familiarize chemistry and its applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods.

Syllabus		**Total Hours:48**
Unit- I	**Structure and Bonding Models**	**9Hrs**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and $\Psi 2$, Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and $\Psi 2$, particle in one dimensional box, molecular orbital theory – bonding in homo- and hetero-nuclear diatomic molecules – energy level diagrams of O2, CO, and NO. π-molecular orbitals of butadiene and benzene, calculation of bond order.

Unit-II	**Modern Engineering materials**	**10Hrs**

Semiconductors – Introduction, basic concept, application
Superconductors: Introduction, Basic concept and Applications.
Supercapacitors: Introduction, Basic concept, Classification and Applications.
Nanomaterials: Introduction, classification, properties and applications of Fullerenes, carbon nanotubes and Graphine nanoparticles.

Unit-III	**Electrochemistry and Applications**	**10Hrs**

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).
Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.
Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygenfuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

Unit-IV	**Polymer Chemistry**	**10Hrs**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.
Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.
Elastomers–Buna-S, Buna-N–preparation, properties and applications.
Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications.
Biodegradable polymers **- poly dioxanone,** Polyglycolic Acid (PGA), Polylactic Acid (PLA).

Unit-V	**Instrumental Methods and applications**	**9Hrs**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification, **Gas chromatography,** HPLC: Principle, Instrumentation and applications.

Course Outcomes(CO):
On completion of this course, student will be able to • Describe Planck's quantum theory, dual nature of matter, Schrodinger equation, molecular orbital Theory and molecular orbital energy level diagram of differentmolecules • Explain Crystal field theory, splitting in octahedral and tetrahedral geometry and themagnetic behavior, Oxidation state, coordination and color of complexes. • Explain the principle of Band diagrams of conductors, superconductor, semiconductorsand insulator and nonmaterial • Discuss the principles of electrochemistry in potentiometry, conductometry, battery and electrochemical sensors • Explain polymerization and the preparation, properties, and applications of thermoplastics &thermosetting, elastomers, & conducting polymers • Discuss the different applications of analytical instruments
Text Books: 1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013. 2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.
Reference Books: 1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020. 2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007. 3. J.M.Lehn, Supra Molecular Chemistry, VCH Publications

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B.Tech. I Year II Semester

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to all Branches of Engineering)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0002T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BS**

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

Syllabus		**Total Hours:45**
Unit-I	**Differential equations of first order and first degree**	**9Hrs**
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 decayElectrical circuits.		
Unit-II	**Linear differential equations of higher order (Constant Coefficients)**	**9Hrs**
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**	**9Hrs**
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**	**9Hrs**
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**	**9Hrs**
Line integral-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		

Course Outcomes(CO):

On completion of this course, student will be able to

- Solve the first order differential equations related to various engineering fields.
- Solve the linear differential equations of higher order with constant coefficients
- Identifysolutionmethodsforpartialdifferentialequationsthatmodelphysical processes.
- Interpret the physical meaning of different operators such as gradient, curland divergence.
- Apply Green's, Stokes and Divergence theorem in work done, circulation, flux and triple integrals.

Text Books:

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
6. Engineering Mathematics I by T.K.V. Iyengar, B.Krishna Gandhi,, S. Chand Publications, 2015 Edition.

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B.Tech. I Year II Semester

Basic Civil & Mechanical Engineering						
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**REG**	**Course Type**
23A0101T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3Hours**	**RG23**	**ES**

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 nations economy.
- Get familiarized with the importance of quality, conveyance and storage of water
- Introduction to basic civil engineering materials and construction techniques

Syllabus	**PART-A**	**TotalHours:48**
Unit–I		**9**

Basics of Civil Engineering: **Role of Civil Engineers in Society- Various Disciplines of CivilEngineering-StructuralEngineering-Geo-technicalEngineering-TransportationEngineering** Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of eachdiscipline-BuildingConstructionandPlanning-ConstructionMaterials-Cement-Aggregate-Bricks-Cementconcrete-Steel.Introductionto Prefabricated construction Techniques

Unit–II		**10**

Fluid Mechanics: Properties of fluids and types of fluids.
Surveying: Objectives of Surveying- Horizontal Measurements-Angular Measurements-IntroductiontoBearingsLevellinginstrumentsusedforlevelling-Simpleproblemsonlevellingandbearings-Contourmapping.

Unit–III		**9**

TransportationEngineeringImportanceofTransportationinNation'seconomicdevelopment- 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)

Syllabus	**PART-B (Mechanical)**	**TotalHours:48**
UNIT I		**10**

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		**10**

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		10

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants. Mechanical Power Transmission - Belt Drives, Chain, Rope drives, 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)

Course Outcomes:

On completion of the course, the student should be able to

1. Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying
2. Realize the importance of Transportation in nation's economy and the engineering measures related to highways in terms of geometrics
3. Understand the importance of water resources and storage structures so that the social responsibilities of water conservation will be appreciated.

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. Appuu Kuttan 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.

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B.Tech. I Year II Semester

ENGINEERING MECHANICS
(Common to All branches of Engineering)

Course Code	L T P	Credits	Exam marks	Exam Duration	Course Type
23A0303T	3 0 0	3	CIE:30 & SEE:70	3 Hours	ES

Course Objectives:

The students completing the course are expected to:

- To get familiarized with different types of force systems.
- To draw accurate free body diagrams representing forces and moments acting on abody to analyze the equilibrium of system of forces.
- To teach the basic principles of center of gravity, centroid and moment of inertia anddetermine 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 ofrigid bodies.

Unit-I		10Hrs

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 dryfriction, coefficient of friction, Cone of Static friction.

Unit-II		12Hrs

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		12Hrs

Centroid: Centroids of simple figures (from basic principles) – Centroids of Compositefigures

Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre ofgravity of composite bodies, Pappus theorems.

Area Moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Productof Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for MassMoments of Inertia, Mass Moment of Inertia of composite bodies.

Unit -IV		12Hrs

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

Unit -V		12Hrs
Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis andplane motion, Work Energy method and Impulse Momentum method.		

Course Outcomes(CO):

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

- Understand the fundamental concepts in mechanics and determine the frictionalforces for bodies in contact.
- Analyze different force systems such as concurrent, coplanar and spatial systemsand calculate their resultant forces and moments.
- Calculate the centroids, center of gravity and moment of inertia of different geometrical shapes.
- Apply the principles of work-energy and impulse-momentum to solve the problemsof rectilinear and curvilinear motion of a particle.
- Solve the problems involving the translational and rotational motion of rigid bodies

Textbooks:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5thEdition, McGraw Hill Education,2017.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition,Pearson Education, Inc., New Delhi, 2022

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education,2017.
2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., 4th Edition, PHI, 2002.
3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam andL. G. Kraige., 6th Edition, John Wiley, 2008.
4. Engineering Mechanics: Principles of Statics and Dynamics, R.C. Hibbler., Pearson Press, 2006.
5. Introduction to Statics and Dynamics, Andy Ruina and Rudra Pratap., Oxford University Press, 2011.

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B.Tech. I Year II Semester

COMMUNICATIVE ENGLISH LAB (Common to all Branches of Engineering)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
2300010P	**0:0:2**	**1**	**CIE:30 SEE:70**	**3 Hours**	**HM**

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 students will get trained in the basic communication skills and also make them ready to face job interviews

List of Experiments	**Total Hours:32**

1. Vowels & Consonants
2. Neutrilization/ Accent Rules
3. Communication Skills & Jam
4. Role Play Or Conversational Practice
5. Email Wriring
6. Resume Writing, Cover Letter, Sop
7. Grpoup Discussion-Methods & Practice
8. Debate - Method & Practice
9. PPT Presentation / Poster Presentation
10. Interview Skills

Course Outcomes(CO):

On completion of this course, student will be able to

1. Analyze the English speech sounds, stress, intonation for better Listening practice
2. Apply communication skills through various language learning activities
3. Application of writing skills through design and preparation of professional Resume & email writing
4. Create effective resonate and prepare themselves to face interviews in future.

Reference Books:

1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Grant Taylor: English Conversation Practice, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. T. Balasubramanyam, A Textbook of English Phonetics for Indian Students,(3rd Ed) Trinity Press.

Web References:

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

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B.Tech. I Year II Semester

CHEMISTRY LAB

(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0008P	0: 0: 3	1	CIE:30 SEE:70	3 Hours	BS

Course Objectives:

- Verify the fundamental concepts with experiments

List of Experiments	Total Hours:48

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Simultaneous estimation of Mn and Cr ions by spectrophotometry in water samples.
10. Wavelength measurement of sample through UV-Visible Spectroscopy
11. Identification of functional groups in organic compounds by IR Spectroscopy.
12. Preparation of nanomaterials by precipitation method
13. Estimation of Ferrous Iron by Dichrometry
14. Determination of Hardness of a groundwater sample
15. pH metric titration of strong acid vs strong base

(**Any 10 experiments from the above list)**

Course Outcomes(CO):

On completion of this course, student will be able to

- Determine the cell constant and conductance of solutions and the strength of an acid by conductometry
- Synthesize of advanced polymer materials
- Measure the strength of an acid present in secondary battery and Ferrous ion using volumetric analysis
- Determine the potentials and EMFs of solutions by Potentiometry
- Identify some organic and inorganic compounds by instrumental methods
- Synthesize of nanomaterials by simple methods

Text Books:

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Jain & Jain. Engineering Chemistry: Dhanapath rai Publications., 2015.
3. S.S.Dara, Experiments and Calculations in Engineering Chemistry: S-Chand Publications,Revised edition, 2008.

Reference Books:

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

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B.Tech. I Year II Semester

ENGINEERING WORKSHOP
(Common to all Branches of Engineering)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0302P	0: 0: 3	1	CIE:30 SEE:70	3 Hours	ES

Course Objectives:

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

Syllabus **Total Hours:32**

1. **Demonstration**: Safety practices and precautions to be observed inworkshop.
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 Tenon 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-circularfit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuit sand make the following connections.
   a)Parallel and series b)Two-way switch c) Go down 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.

Course Outcomes(CO):

On completion of this course, student will be able to

1. Identify workshop tools and their operational capabilities.
2. Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
3. Apply fitting operations in various applications.
4. Apply basic electrical engineering knowledge for House Wiring Practice.

Text Books:

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.

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3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137,

E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

B.Tech. I Year II Semester

ENGINEERING MECHANICS LAB

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0304P	0:0:3	1.5	CIE:30 SEE:70	3 Hours	ES

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.

Syllabus	Total Hours: 48

List of Experiments

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. 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.
4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. 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
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. 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.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever

Course Outcomes:

On completion of the course, the student should be able to

1. Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying
2. Realize the importance of Transportation in nation's economy and the engineering measures related to highways in terms of geometrics
3. Understand the importance of water resources and storage structures so that the social Responsibilities of water conservation will be appreciated.

References:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5thEdition, McGraw HillEducation,2017.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14thEdition, Pearson Education, Inc., New Delhi, 2022.

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)

NELLORE–524317 (A.P) INDIA

B.TECH IN MECHANICAL ENGINEERING
COURSE STRUCTURE AND SYLLABI
UNDER B Tech ME- RG 23 REGULATIONS

II Year I Semester

Department of Mechanical Engineering

Vision

To evolve as a prospective learning center producing competent Mechanical Engineers to full fill the ever-changing needs of society and industry demands.

Mission

M1. To Impart comprehensive knowledge and experience in Mechanical Engineering domain through the effective implementation of Teaching-Learning methodologies

M2. To promote the culture of Interdisciplinary learning and facilitate Industrial training to resolve global Engineering issues

M3. To Impart training on modern drafting and analysis software sharpening computational capabilities and promoting higher studies

M4. To Initiate Industry-Institute Interface facilitating skill enhancement keeping pace with emerging industrial trends by Infusing ethical values

Program Educational Outcomes

PE01. Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PE02. Pursue successful professional career in industry, academia or research.

PE03. Engage in continuous learning to keep abreast with emerging technologies with the sense of professional ethics.

PE04. Contribute in multi-disciplinary teams through effective interpersonal skills

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Utilize the knowledge of materials and manufacturing principles to plan, design and monitor the production operations of an Industry..

PSO2: Employ the governing laws of thermodynamics, heat transfer and refrigeration & air-conditioning to design and develop thermo-fluid system.

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B.Tech. II Year I Semester (Theory-5, Lab-3, SEC-1, MC-1)							
S.No	**Category**	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	BS	23A0013T	Transforms and Numerical Methods	3	0	0	3
2.	HM	23A0021T	Universal Human Values–Understanding Harmony & Ethical human conduct	2	1	0	3
3.	PC	23A0305T	Thermodynamics	2	0	0	2
4.	PC	23A0306T	Mechanics of Solids	3	0	0	3
5.	PC	23A0307T	Material Science and Metallurgy	3	0	0	3
6.	PC	23A0308P	Mechanics of Solids and Materials Science Lab	0	0	3	1.5
7.	PC	23A0309P	Computer-aided Machine Drawing	0	0	3	1.5
8.	ES	23A0510P	Python programming Lab	0	0	2	2
9.	SEC	23A0406P	Embedded Systems and IoT	0	1	2	1
10.	MC	23A0109T	Environmental Science	2	0	0	-
			Total	**15**	**2**	**10**	**20**

Category	**Credits**
Humanities and Social Science including Management (HM)	03
Basic Sciences (BS)	03
Engineering Sciences (ES)	02
Professional Core (PC)	11
Skill Enhancement Courses (SEC)	01
Mandatory Courses (MC)	00
Total	20

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B.Tech. II Year I Semester

Transform and Numerical Methods					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0013T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3Hours**	**BS**

Syllabus		**TotalHours:45**
Unit-I	**Solution of Algebraic & Transcendental Equations and Interpolation**	**9Hrs**
Introduction-Bisection Method, Regula-falsi method and Newton Raphson method 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-II	**Solution of Initial value problems to Ordinary differential equations**	**9Hrs**
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-III	**Laplace Transforms**	**9Hrs**
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. Applications of LT to Differential Equations		
Unit-IV	**Fourier series**	**9Hrs**
Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions.		
Unit- V	**Fourier transforms**	**9Hrs**
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. Finite Fourier Sine & Cosine transform.		

Course Outcomes: After successful completion of this course, the students should be able to:

CO1. Apply numerical methods to solve algebraic and transcendental equations, form the interpolating Polynomials and fitting of curve.

CO2. Solve the differential equations numerically

CO3. Understand the concept of Laplace Transforms, find the Laplace Transforms of different functions and apply Laplace Transforms to solve the Differential Equations.

CO4. Solve the Fourier Series expression for the different periodic functions.

CO5. Solve Fourier Sine and Cosine integrals. Understand Fourier Transforms. Apply properties of Fourier transforms

Textbooks:

1. B.S.Grewal, Higher Engineering Mathematics, KhannaPublishers,2017, 44^{th} Edition
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India

Reference Books:

1. R.K.Jainand S.R.K.Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd., 2021 5^{th} Edition (9th reprint).
2. B.V.Ramana, Higher Engineering Mathematics, Mc Graw Hill publishers
3. Alan Jeffrey, Advanced Engineering Mathematics, Elsevier

Online Learning Resources:

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

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B.Tech. II Year I Semester

Universal Human Values– Understanding Harmony & Ethical human conduct

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
23A0021T	2:1:0:0	3	CIE:30 SEE:70	3 Hours	HM

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.

Syllabus — **Total Hours:30**

Unit-I	INTRODUCTION TO VALUE EDUCATION	6 Hrs

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Practice Session PS1 Sharing about Oneself
self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Exploring Human Consciousness, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations, Exploring Natural Acceptance, Practice Sessions for UNIT I – Introduction to Value Education, PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Unit-II	HARMONY IN THE HUMAN BEING	6 Hrs

Understanding Human being as the Co-existence of the self and the body, Distinguishing between the Needs of the self and the body, Exploring the difference of Needs of self and body., The body as an Instrument of the self, Understanding Harmony in the self, Exploring Sources of Imagination in the self, Harmony of the self with the body, Programme to ensure self-regulation and Health, Exploring Harmony of self with the body
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

Unit-III	HARMONY IN THE FAMILY AND SOCIETY	6 Hrs

Harmony in the Family – the Basic Unit of Human Interaction, Trust' – the Foundational Value in Relationship, Exploring the Feeling of Trust, 'Respect' – as the Right Evaluation
Exploring the Feeling of Respect, Other Feelings, Justice in Human-to-Human Relationship
Understanding Harmony in the Society, Vision for the Universal Human Order, Exploring Systems to fulfil Human Goal

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

Unit-IV	HARMONY IN THE NATURE/EXISTENCE	6 Hrs

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among, the Four Orders of Nature, Exploring the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence
Exploring Co-existence in Existence.

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

Unit-V	IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK AT PROFESSIONAL ETHICS	6 Hrs

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct
Exploring Ethical Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Exploring Humanistic Models in Education, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession, Exploring Steps of Transition towards Universal Human Order

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

Course Outcomes(CO):

On completion of this course, student will be able to

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)

Textbooks:

1. 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
2. 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)

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%20 Lecture%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
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview.

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B.Tech. II Year I Semester

Thermodynamics					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0305T	**2: 0: 0**	**2**	**CIE:30 SEE:70**	**3 Hours**	**PC**

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 Psychometric.

Syllabus		**Total Hours:32**
Unit- I	**Basic concepts of Thermodynamics**	**7**

Introduction: Basic Concepts : System, Boundary, Surroundings, Types of Systems ,Control volume, Universe, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property –types – Intensive and Extensive , Enthalpy.

Unit- II	**First law of Thermodynamics**	**7**

Energy in State and in Transition — Change of State –Process, Cycle, Work and Heat, Point and Path function. Zeroth Law of Thermodynamics – Joule’s Experiment – First law of Thermodynamics and applications, Steady Flow Steady State Energy Equation. PMM-I, Limitations of the First Law.

Unit- III	**Second law of Thermodynamics**	**6**

Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance. 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. Elementary Treatment of the Third Law of Thermodynamics, Availability and Irreversibility- Causes of Irreversibility -Exergy concept –T ds equations - Gibbs and Helmholtz Functions, Maxwell Relations .

Unit- IV	**Properties of steam and use of steam tables**	**6**

Pure Substance, P-v-T- surfaces, T-s and h-s diagrams, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction, Steam tables, Mollier charts .Steam Calorimetry .Evaluation of Thermodynamic properties of steam for various processes. Clausius Clapeyron Equation.

Unit- V	**Introduction to Refrigeration & Air Conditioning**	**6**

Introduction to Refrigeration: Air Refrigeration cycle, COP ,Vapour Compression Refrigeration(VCR) cycle, VCR system Components, Vapour Absorption Refrigeration system. Refrigerants.

Introduction to Air Conditioning: Psychometric properties & processes – characterization of sensible and latent heat loads – load concepts of SHF. Requirements of human comfort and concept of effective temperature- comfort chart .

Course Outcomes(CO):

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

Text Books:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Y.A.Cengel & M.A.Boles ,Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010.

Reference Books:

1. Claus Borgnakke Richard E. Sonntag, G J Van Wylen Fundamentals of Thermodynamics, 7/e, Wiley, 2009
2. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021
3. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, New edition
4. P.Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011.

Online Learning Resources:

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

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B.Tech. II Year I Semester

Mechanics of Solids					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0306T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives

- Understand the behaviour of basic structural members subjected to uni axial and bi axial loads.
- Apply the concept of stress and strain to analyse and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
- Students will learn all the methods to analyse beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams for beams.
- Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
- Design and analysis of Industrial components like pressure vessels.

Syllabus		**Total Hours:48**
Unit- I	**SIMPLE STRESSES & STRAINS**	**10**

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**	**8**

Definition of beam – Types of beams –Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, u.d.l, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of abeam.

Unit- III	**FLEXURAL STRESSES**	**10**

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**	**10**

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	10

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

Course Outcomes(CO):

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

CO2. Analyze beams and draw correct and complete shear and bending moment diagrams for beams.

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.

CO4. Model & Analyze the behavior of basic structural members subjected to various loads

CO5. Design and analysis of Industrial components like pressure vessels.

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:

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

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B.Tech. II Year I Semester

Material Science & Metallurgy					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0307T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- 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

Syllabus		**Total Hours:48**
Unit- I	**Structure of Metals and Constitution of alloys**	**10**

Crystallization of metals, Packing Factor - SC, BCC, FCC & HCP- line density, plane density. Grain and grain boundaries, effect of grain boundaries – determination of grain size.
Imperfections, Slip and Twinning.
Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds
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, peritectoid reactions, 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**	**8**

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast iron. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

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	10

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	10

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	10

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.

Course Outcomes:

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

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:

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

Online Learning Resources:

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

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B.Tech. II Year I Semester

Mechanics of Solids & Material Science Lab					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0308P	**0: 0:3: 0**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- 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.

Syllabus	**Total Hours:48**

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

A) MECHANICS OF SOLIDS LAB:

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 SCIENCE LAB:

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).

Course Outcomes:

CO1: Understand the stress strain behavior of different materials.

CO2: Evaluate the hardness of different materials.

CO3: Explain the relation between elastic constants and hardness of materials.

CO4: Identify various microstructures of steels and cast irons.

CO5: Evaluate hardness of treated and untreated steels.

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B.Tech. II Year I Semester

Computer-Aided Machine Drawing					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0309P	**0: 0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

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 in mating components

Syllabus	Total Hours:48

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

Course Outcomes:

CO1. Demonstrate the conventional representations of materials and machine components.

CO2. Model riveted, welded and key joints using CAD system.

CO3. Create solid models and sectional views of machine components.

CO4. Generate solid models of machine parts and assemble them.

CO5. Translate 3D assemblies into 2D drawings.

Text Books:

1. Machine Drawing by K.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
3. Production Drawing by K.L.Narayana, P.Kannaiah and K.Venkat Reddy P.Kannaiah and K.Venkat Reddy

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:

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

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B.Tech. II Year I Semester

Python Programming					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0510P	**0: 0: 2**	**2**	**CIE:30 SEE:70**	**3 Hours**	**ES**

Course Objectives:

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries.
- Implement Functions, Units and Regular Expressions in Python Programming and to create practical and contemporary applications using these.

Syllabus		**Total Hours:32**
Unit- I	**Python Programming Language, Control Flow Statements**	**7**

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 and Strings**	**7**

Functions: Built-In Functions, Commonly Used Units, 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, Tuples and Sets	**6**

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, Frozen set.

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, Object-Oriented Programming	**6**

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Unit, Reading and Writing CSV Files, Python os and os.path Units.

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	Data Science	6

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

Course Outcomes:

CO1. Classify data structures of Python (L4)

CO2. Apply Python programming concepts to solve a variety of computational problems (L3)

CO3. 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)

CO4. Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)

CO5. Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)

CO6. Propose new solutions to computational problems (L6)

Text Books:

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

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:

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

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-austinembedded-systems-shape-the-world-microcontroller-inputoutput? index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-

+Shape+The+ World%3A+ Microcontroller+Input%2FOutput&source=edX&productcategory=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-valenciaintroduction-
6. to-the-internet-ofthings?
index=product&queryID=e1322674dcb3d246be981d0669265399&position=4
7. &linked_from=autocomplete&c=autocomplete.
8. https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-anddevices?
9. 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.
10. Virtual Labs - http://vlabs.iitkgp.ac.in/rtes/
11. Virtual Labs -https://cse02-iiith.vlabs.ac.in/
12. Virtual Labs - https://iotvirtuallab.github.io/vlab/Experiments/index.html

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B.Tech. II Year I Semester

Embedded Systems & IoT					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0406P	**0: 1: 2**	**1**	**CIE:30 SEE:70**	**3 Hours**	**SEC**

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.

Syllabus **Total Hours:48**

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.

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.

Course Outcomes:

CO1. Comprehend Microcontroller-Transducers Interface techniques.

CO2. Establish Serial Communication link with Arduino

CO3. Analyse basics of SPI interface.

CO4. Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor.

CO5. Realize the revolution of internet in mobile devices, cloud and sensor networks.

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.

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B.Tech. II Year I Semester

Environmental Science					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0109T	**2: 0: 0**	**0**	**CIE:30**	**3 Hours**	**MC**

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.

Syllabus		**Total Hours:32**
Unit- I		**7**

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		**7**

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		6

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		6

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		6

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..

Course Outcomes:

CO1. Classify data structures of Python (L4)
CO2. Apply Python programming concepts to solve a variety of computational problems (L3)
CO3. 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)
CO4. Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
CO5. Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)
CO6. Propose new solutions to computational problems (L6)

Text Books:

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

Reference Books:

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

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)

NELLORE–524317 (A.P) INDIA

B.TECH IN MECHANICAL ENGINEERING
COURSE STRUCTURE AND SYLLABI
UNDER B Tech ME- RG 23 REGULATIONS

II Year II Semester

Department of Mechanical Engineering

Vision

To evolve as a prospective learning center producing competent Mechanical Engineers to full fill the ever-changing needs of society and industry demands.

Mission

M1. To Impart comprehensive knowledge and experience in Mechanical Engineering domain through the effective implementation of Teaching-Learning methodologies

M2. To promote the culture of Interdisciplinary learning and facilitate Industrial training to resolve global Engineering issues

M3. To Impart training on modern drafting and analysis software sharpening computational capabilities and promoting higher studies

M4. To Initiate Industry-Institute Interface facilitating skill enhancement keeping pace with emerging industrial trends by Infusing ethical values

Program Educational Outcomes

PE01. Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PE02. Pursue successful professional career in industry, academia or research.

PE03. Engage in continuous learning to keep abreast with emerging technologies with the sense of professional ethics.

PE04. Contribute in multi-disciplinary teams through effective interpersonal skills

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Utilize the knowledge of materials and manufacturing principles to plan, design and monitor the production operations of an Industry..

PSO2: Employ the governing laws of thermodynamics, heat transfer and refrigeration & air-conditioning to design and develop thermo-fluid system.

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E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

B.Tech. II Year II Semester (Theory-5, Lab-3, SEC-1, MC-1)

No.	Category	Course Code	Course Name	L	T	P	Credits
1.	HM	23A0027T	Industrial Management	2	0	0	2
2.	BS	23A0016T	Complex Variables, Probability and Statistics	3	0	0	3
3.	PC	23A0310T	Manufacturing processes	3	0	0	3
4.	PC	23A0311T	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5.	PC	23A0312T	Design of Machine Members	3	0	0	3
6.	PC	23A0313P	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7.	PC	23A0314P	Manufacturing processes Lab	0	0	3	1.5
8.	HM	23A0026P	Soft Skills	0	1	2	2
9.	PC	23A0413T	Design Thinking & Innovation	1	0	2	2
			Total	**15**	**1**	**10**	**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation							

Category	**Credits**
Humanities and Social Science including Management(HM)	04
Basic Science (BS)	03
Professional Core (PC)	14
Total	21

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B.Tech. II Year II Semester

Industrial Management					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0027T	**2:0:0**	**2**	**CIE:30 SEE:70**	**3 Hours**	**HM**

Course Objectives:

- Introduce the scope and role of industrial engineering and the techniques for optimal design of layouts.
- 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.

Syllabus		**Total Hours:48**
Unit-I	**Introduction and Plant Layout**	**8 Hrs**

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, quantitative tools of IE and productivity measurement. Concepts of management, importance, functions of management, scientific management, Taylor's principles, Fayol's principles of management.

Unit -II	**Work Study**	**10 Hrs**

PLANTLAYOUT: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts.

WORK STUDY: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro- motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

Unit -III	**Statistical Quality Control & TQM**	**10 Hrs**

STATISTICAL QUALITY CONTROL: Quality control, Queuing assurance and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – X and R – charts X and S ~~charts~~ and their applications, simple numerical examples.

TOTALQUALITY MANAGEMENT: Elements of TQM – Continuous Improvement – zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma– definition, basic concepts.

Unit -IV	**Financial Management**	**8 Hrs**

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 Investment Decisions– Investment Evaluation criteria-NPV, IRR, PI, Payback Period, and ARR, numerical problems.

Unit -V	Human Resource Management & Value Analysis	11 Hrs

HUMAN RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job- evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, and types.

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

MARKETING MANAGEMENT: Meaning, Definition, Functions, Marketing Mix, Product Life Cycle (PLC).

Course Outcomes (CO):

On completion of this course, student will be able to

- Learn about how to design the optimal layout. (L1)
- Demonstrate work study methods. (L3)
- Explain Quality Control techniques. (L2)
- Discuss the financial management aspects. (L3)
- Understand the human resource management methods. (L2)

Textbooks:

1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications(P)Ltd.
2. Martand Telsang, Industrial Engineering and Production Management, S. Chand & Company Ltd. New Delhi.

Reference Books:

1. Bhattacharya DK, Industrial Management, S. Chand publishers.
2. J. GMonks, Operations Management,3/e, McGraw Hill Publishers.
3. T. R. Banga, S. C. Sharma, N. K. Agarwal, Industrial Engineering and Management Science, Khanna Publishers.
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 Resources:

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

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B.Tech. II Year II Semester

Complex Variables , Probability and Statistics					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0016T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3Hours**	**BS**

Syllabus		**Total Hours:48**
Unit-I	**Complex Variable – Differentiation**	**10Hrs**

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**	**10Hrs**

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).

Unit-III	**Probability theory**	**10Hrs**

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	**Probability Distributions**	**9Hrs**

Probability distribution - Binomial, Poisson approximation to the binomial distribution, Normal distribution and their properties.

Unit-V	**Estimation and Testing of hypothesis, large sample tests**	**9Hrs**

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.
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.

Course Outcomes: After successful completion of this course, the students should be able to:

- Understand Cauchy Riemann equations, analytic functions and various properties of analytic functions.
- Understand Cauchy's theorem, Cauchy integral formulas, Classify singularities and poles.
- Evaluate complex integrals using the residue theorem.
- Apply Probability theory to find the chances of happening of events.
- Understand various probability distributions and calculate their statistical constants.
- Analyze to test various hypotheses included in theory and types of errors for large samples.

Text books:
1. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited. 2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.India 3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition
Reference Books: 1. ErwinKreyszig, Advanced Engineering Mathematics, JohnWiley&Sons, 2018, 10th Edition. 2. R.K.JainandS.R.K.Iyengar,AdvancedEngineeringMathematics,AlphaScienceInternationalLtd.,2021 5th Edition(9th reprint). 3. Ronald E. Walpole, Probability and Statistics for Engineers and Scientists, PNIE 4. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publications,2014, Third Edition (Reprint 2021)
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

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B.Tech. II Year II Semester

Manufacturing Processes					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0310T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- 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.

Syllabus		**Total Hours:48**
Unit- I	**Casting**	**10**

Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types 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 principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

Unit- II	**Welding**	**8**

Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG& MIG welding. Electro–slag welding.

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 –causes and remedies.

Unit- III	**Bulk Forming**	**10**

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

Hot working and Cold working-Strain hardening and Annealing. Bulk forming processes: Forging-Types of Forging, forging defects and remedies;

Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements.

Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing

Unit- IV	**Sheet metal forming**	**10**

Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

Unit- V	Additive manufacturing	10
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		

Course Outcomes(CO):

- Design the patterns and core boxes for metal casting processes
- Understand the different welding processes
- Demonstrate the different types of bulk forming processes
- Understand sheet metal forming processes
- Learn about the different types of additive manufacturing processes

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 & Distributors Pvt.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:

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

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B.Tech. II Year II Semester

Fluid Mechanics & Hydraulic Machines

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0311T	3: 0: 0	3	CIE:30 SEE:70	3 Hours	PC

Course Objectives:

- Understand the properties of fluids, manometry, hydrostatic forces acting on different surfaces
- Understand the kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations.
- Understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

Syllabus		Total Hours:48
Unit- I	**Fluid statics, Buoyancy and floatation**	**10**

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, 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 of meta center height. Stability analysis and applications.

Unit- II	**Fluid kinematics, Fluid dynamics**	**8**

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Unit- III	**Boundary Layer Theory**	**10**

Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel- total energy line-hydraulic gradient line.

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Unit- IV	**Basics of turbo machinery**	**10**

Basics of turbo machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies.

Unit- V	Performance of hydraulic turbines	10

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, NPSH characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank,. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Centrifugal pumps: classification, working, work done – manometric head- losses and efficiencies- specific speed- performance characteristic curves.

Course Outcomes(CO):

- Understand the basic concepts of fluid properties.
- Estimate the mechanics of fluids in static and dynamic conditions.
- Apply the Boundary layer theory, flow separation and dimensional analysis.
- Estimate the hydrodynamic forces of jet on vanes in different positions.
- Understand the working Principles and performance evaluation of hydraulic pump and turbines.

Text Books:

1. Y.A. Cengel, J.M. Cimbala, Fluid Mechanics, Fundamentals and Applications, 6/e, McGraw Hill Publications, 2019.
2. Introduction to Fluid Mechanics and Fluid Machines by Som & Biswas, 2017.
3. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, S K Kataria & Sons, 2013.
4. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.

Reference Books

1. Dixon, Fluid Mechanics and Thermodynamics of Turbomachinery, 7/e, Elsevier Publishers, 2014
2. RK Bansal, Fluid Mechanics and Hydraulic Machines, 10/e, Laxmi Publications (P)Ltd, 2019.
3. D. Rama Durgaiah, Fluid Mechanics and Machinery, 1/e, New Age International, 2002.

Online Learning Resources:

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

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B.Tech. II Year II Semester

Design of Machine Members					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0312T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- Provide an introduction to design of machine elements.
- Familiarize with fundamental approaches to failure prevention for static and dynamic loading.
- Explain design procedures to different types of joints.
- Teach principles of clutches and brakes and design procedures.
- Instruct different types of bearings and design procedures.

Syllabus		**Total Hours:48**
Unit- I	**Introduction, Design for Static and Dynamic loads**	**10**

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 combinations ,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**	**8**

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**	**10**

Design of shafts subjected bending ,torsion and axial loading shafts subjected to fluctuating loads using shock factors.

Couplings: design of flange and bushed pin couplings, universal couplings. muff coupling and compressive couplings.

Unit- IV	**Design of Clutches, Brakes and Springs**	**10**

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: spring materials ,Design of helical compression, tension, torsion and leaf springs.

Unit- V	Design of Bearings and Gears	10

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.

Course Outcomes(CO):

- Estimate safety factors of machine members subjected to static and dynamic loads.
- Design the fasteners subjected to variety of loads.
- Select of standard machine elements such as keys, shafts, couplings, springs and bearings.
- Design of clutches, brakes and springs.
- Design of bearing and gears.

Text Books:

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.
3. Dr. N. C. Pandya &Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.
4. Fundamentals of Design and Manufacturing , G. K. Lal, Vijay Gupta, N. Venkata Reddy, Narosa Publishing house.

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. Machine design sham series

Online Learning Resources:

1. https://www.yumpu.com/en/document/view/18818306/lesson-3-course-name-design-ofmachine-elements-1-nptel
2. https://www.digimat.in/nptel/courses/video/112105124/L01.html
3. https://dokumen.tips/documents/nptel-design-of-machine-elements-1.html
4. https://archive.nptel.ac.in/courses/112/105/112105125/
5. https://www.coursera.org/learn/machine-design1

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B.Tech. II Year II Semester

Fluid Mechanics & Hydraulic Machinery Lab					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0313P	**0: 0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

To impart practical exposure on the performance evaluation methods of various flow measuring equipment and hydraulic turbines and pumps.

Syllabus	**Total Hours:48**

List of Experiments

1. Measurement & Calibration of Flow of Orifice meter
2. Measurement & Calibration of Flow of Venturimeter.
3. Impact of jets on Vanes.
4. Determination of friction factor for a given pipeline.
5. Determination of loss of head due to sudden contraction in a pipeline
6. Turbine flow meter.
7. Performance Test on Pelton Wheel.
8. Performance Test on Francis Turbine.
9. Performance Test on Kaplan Turbine.
10. Performance Test on Single Stage Centrifugal Pump.
11. Performance Test on Multi Stage Centrifugal Pump.
12. Performance Test on Reciprocating Pump.

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).

Course Outcomes:

- Demonstrate the devices used for measuring flow.
- Compute major losses in pipes.
- Illustrate the operating parameters of turbines.
- Explain the working of different types of pumps.
- Explain the devices used for measuring flow.

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B.Tech. II Year II Semester

Manufacturing Processes Lab					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0314P	**0: 0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**
Course Objectives:					
. Acquire practical knowledge on Metal Casting, Welding, Press Working and Processing of Plastics					
Syllabus					**Total Hours:48**

List of Experiments

1. Design and making of pattern
   i. Single piece pattern
   ii. Split pattern
2. Sand properties testing
   i. Sieve analysis (dry sand)
   ii. Clay content test
   iii. Moisture content test
   iv. Strength test (Compression test & Shear test)
   v. Permeability test
3. Mould preparation
   i. Straight pipe
   ii. Bent pipe
   iii. Dumble
   iv. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
   i. Lap joint
   ii. Butt joint
6. Injection Molding
7. Blow Molding
8. Simple models using sheet metal operations
9. Study of deep drawing and extrusion operations
10. To make weldments using TIG/MIG welding
11. To weld using Spot welding machine
12. To join using Brazing and Soldering
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

Course Outcomes:

- Make moulds for sand casting.
- Fabricate different types of components using various manufacturing techniques.
- Adapt unconventional manufacturing methods.
- Develop Different Weld joints.
- Explain different types of 3d Printing techniques.

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B.Tech. II Year II Semester

Soft Skills

Course Code	L:T: P	Credits	Exam marks	Exam Duration	Course Type
23A0026P	0: 1: 2	2	CIE:30 SEE:70	3 Hours	HM

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

Syllabus		Total Hours:48
Unit - I	Soft Skills & Communication Skills	10 Hrs

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	Problem Solving & Decision Making	8Hrs

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 - III	Critical Thinking	10 Hrs

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 - IV	Emotional Intelligence & Stress Management	10 Hrs
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**	**10 Hrs**
Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Job interview etiquette - Netiquette - Etiquette in interaction- Cell phone etiquette - Dining etiquette- Corporate grooming tips -Overcoming challenges		

Course Outcomes (CO):
On completion of this course, student will be able to

- List out various elements of soft skills
- Describe methods for building professional image
- Apply critical thinking skills in problem solving
- Analyze the needs of an individual and team for well-being
- Assess the situation and take necessary decisions
- Create a productive workplace atmosphere using social and work-life skills ensuring personal and emotional well-being

Textbooks:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press,
2. Pap/Cdr edition 2012
3. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for
4. 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
5. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
6. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
7. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher :Vayu Education of India, 2014

Web links:

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-businessetiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

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B.Tech. II Year II Semester

Design Thinking & Innovation					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0413T	**1: 0: 2**	**2**	**CIE:30 SEE:70**	**3 Hours**	**PC**

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.

Syllabus		**Total Hours:48**
Unit- I	**Introduction to Design Thinking**	**8**

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**	**10**

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**	**10**

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**	**10**

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**	**10**

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.

Course Outcomes(CO):

- 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)

Text Books:

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
5. Fundamentals of Design and Manufacturing -- K.Venkata Reddu , Narosa publications

Online Learning Resources:

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

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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NELLORE–524317 (A.P) INDIA

B.TECH. (Regular-Full time)
MECHANICAL ENGINEERING
COURSE STRUCTURE AND SYLLABUS
UNDER B Tech ME- RG 23 REGULATIONS

III YEAR I SEMESTER

Department of Mechanical Engineering

Vision

To evolve as a prospective learning center producing competent Mechanical Engineers to full fill the ever-changing needs of society and industry demands.

Mission

M1. To Impart comprehensive knowledge and experience in Mechanical Engineering domain through the effective implementation of Teaching-Learning methodologies

M2. To promote the culture of Interdisciplinary learning and facilitate Industrial training to resolve global Engineering issues

M3. To Impart training on modern drafting and analysis software sharpening computational capabilities and promoting higher studies

M4. To Initiate Industry-Institute Interface facilitating skill enhancement keeping pace with emerging industrial trends by Infusing ethical values

Program Educational Outcomes

PE01. Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PE02. Pursue successful professional career in industry, academia or research.

PE03. Engage in continuous learning to keep abreast with emerging technologies with the sense of professional ethics.

PE04. Contribute in multi-disciplinary teams through effective interpersonal skills

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Utilize the knowledge of materials and manufacturing principles to plan, design and monitor the production operations of an Industry.

PSO2: Employ the governing laws of thermodynamics, heat transfer and refrigeration & air-conditioning to design and develop thermo-fluid system.

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B.Tech. III Year I Semester (Theory-6, Lab-3, SE-1, MC-1)

S.No.	category	Course Code	Course Name	L	T	P	Credits
1.	PC	23A0315T	Machining Process	3	0	0	3
2.	PC	23A0316T	Thermal Engineering	3	0	0	3
3.	PC	23A0317T	Metrology and Measurements	3	0	0	3
4.	PC	23A0522T	Introduction to Quantity Technologies and its Application	3	0	0	3
5.	-	-	**Professional Elective-I**	3	0	0	3
	PE	23A0318Ta	1. Tool Design				
		23A0318Tb	2. Automobile Engineering				
		23A0318Tc	3. Mechanical behaviour of Materials				
		23A0318Td	4. Work study and Ergonomics				
		23A0318Te	5. Nano Technology				
6.	OE	--	**Open Elective-I**	3	0	0	3
7.	PC	23A0320P	Thermal Engineering Lab	0	0	3	1.5
8.	PC	23A0321P	Dynamics lab	0	0	3	1.5
9.	SEC	23A0322P	**Skill Enhancement course** Machine Tools & Metrology lab	0	1	2	2
10.	ES	23A0420P	Tinkering Lab	0	0	2	1
11.	PR	23A0323	**Evaluation of Community Service Internship** Community Service Internship /Project	-	-	-	2
			Total	18	1	10	26

Category	Credits
Professional Core (PC)	15
Professional Elective (PE)	03
Open Elective Course (OE)	03
Internships & Project work (PR)	02
Skill Enhancement Course (SEC)	02
Engineering Science (ES)	01
Total	26

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23A0148T	Green Buildings	CIVIL
2.	23A0149T	Construction Technology and Management	
3.	23A0222T	Electrical Safety Practices and Standards	EEE
4.	23A0442T	Electronic Circuits	ECE
5.	23A0545T	Java Programming	CSE & Allied
6.	23A0546T	Fundamentals of Artificial Intelligence	
7.	23A0547T	Quantum Technologies and Applications	
8.	23A0027T	Mathematics for Machine Learning and AI	Mathematics
9.	23A0034T	Materials Characterization Techniques	Physics
10.	23A0040T	Chemistry of Energy Systems	Chemistry
11.	23A0044T	English for Competitive Examinations	Science and Humanities
12.	23A0051T	Entrepreneurship and New Venture Creation	

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B.Tech. III Year I Semester

Machining Processes					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0315T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

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

- Gain knowledge on working principle of different metal cutting processes and familiarize with cutting forces, machining calculations and cutting fluids.
- Make the student learn about principles of lathe and Drilling machines.
- Make the student learn about principles of Grinding and Milling machines.
- To acquire knowledge in the elementary mechanism and machinability of materials with different Mechanical and Electrical energy based Machining Processes.
- To make student familiar with various advanced machining operations.

Syllabus		**Total Hours:36**
Unit – I	**Metal Cutting and Tool Life**	**8 Hrs**

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry & specifications 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	**Lathe, Drilling, shaping, slotting and Machining Processes**	**7Hrs**

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, Grinding, surface finishing machine, and Work holding Devices**	**7 Hrs**

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.
Principles of design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping –types.

Unit - IV	**Mechanical & Electrical Energy Based Unconventional Processes**	**7 Hrs**

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, Thermal and Electro Chemical Energy Based Unconventional Processes	7 Hrs

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Operation of various machines like lathe, drilling, grinding, slotting, shaping, milling etc
- Practical exposure on flat surface machining, milling and grinding operations
- Illustrate advanced machining processes, cutting tools and cutting fluids for a specific material and part features.
- Differentiate Electrical Energy Based machining processes, mechanism of metal removal, machine tool selection.
- Interpret Electro Chemical machining process, economic aspects of ECM

Text Books:

1. Kalpakzian, Manufacturing Technology, Pearson Seventh edition. (2018)
2. R.K. Jain and S.C. Gupta, Production Technology, Khanna Publishers, 17th edition, 2002.
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. H.M.T. (Hindustan Machine Tools), Production Technology, TMH, 1st edition, 2001
3. P.N. Rao, Manufacturing Technology Vol II, Tata McGraw Hill, 4th edition, 2013
4. Halmi A Yousuf & Harson, Machine Technology Machine tools and operations, CRC Press Taylor and Francies, 2008.
5. B.S.Raghu Vamshi, Workshop Technology – Vol II, 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

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B.Tech. III Year I Semester

Thermal Engineering					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0316T	**3:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PC**

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

- Impart the knowledge on I C Engine
- Demonstrate fuel systems, Cooling modes and types of ignitions systems.
- Explain the fuel and combustion systems variables and its effects.
- Study of engine Performance and its characteristics
- Instruct the awareness on Air compressors and exercise the problems on compressors

Syllabus		**Total Hours:42**
Unit- I	**I.C. Engines**	**9Hrs**

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, Cooling & Lubrication Systems, Ignition System**	**9Hrs**

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**	**8Hrs**

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, working of ORSAT apparatus, Bharat Stage (BS) VI emission standards.

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**	**8Hrs**

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**	**8Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand working of different I.C Engines and recognize basic elements and subsystems of an I.C. Engine
- 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.
- Analyze the Flame Speed and Effect of Engine Variables and evaluate the abnormal combustion effects and its causes.
- 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.
- Familiarized the working principle of various types of air compressors and solve problems related to reciprocating air compressor.

Text Books:

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

Reference Books:

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

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B.Tech. III Year I Semester

Metrology and Measurements					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0317T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

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

- Explain the system of limits, fits &tolerances and design of gauges.
- Identify the use of flatness and surface gauges
- Know the measurement of screw thread, Gear profiles.
- Describe the Measurement of Displacement and Strain.
- Illustrate the measuring process of Pressure, Force and Torque.

Syllabus		**Total Hours:36**
Unit-I	**Concept of measurement**	**8Hrs**

Concept of Measurement: 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, Concept of feedback Control systems.

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

Linear Measurement: Linear measuring instruments: Vernier instruments, micro meters, 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**	**7Hrs**

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-Ra , Rz values, Methods of measurement of surface finish-profilograph, talysurf, BIS symbols for indication of surface roughness.

Introduction to 3D Scanning, Components and Operation, Data Processing, Practical Applications.

Fundamentals of Laser Metrology, Applications, Operation of Laser Metrology Systems, Non-contact measurement advantages and limitations.

Unit-III	**Screw Thread and Gear Measurement**	**7Hrs**

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	7Hrs

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	7Hrs

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Explain measurement principles, units, standards, sensitivity, precision, and accuracy in measurement systems.
- Demonstrate use of vernier calipers, micrometers, and sine bars for measuring component dimensions.
- Interpret surface roughness parameters (CLA, RMS, Ra, Rz) and describe measurement methods
- Calculate screw thread parameter and gear accuracy using constant chord, base tangent methods, and gauges.
- Explain the measurement of the static and dynamic parameters by using transducers.
- Summarize principles and limitations of laser metrology and 3D scanning for component evaluation.

Text Books:

1. Beckwith, Marangoni, Linehard, Mechanical Measurements, 6/e, PHI, 2013.
2. R.K. Jain, Engineering Metrology, 20/e, Khanna Publishers, 2013.
3. J.P. Holman, Experimental Methods for Engineers, McGraw-Hill, 8/e, 2011.

Reference Books:

1. S P Venkateshan, Mechanical Measurements, Ane Books Pvt. Ltd.,2/e, 2015.
2. Mahajan, Engineering Metrology, 2/e, Dhanpat Rai, 2013.
3. S.Bhaskar, Basic Principles - Measurments and Control Systems, Anuradha Publications, 2014.
4. Anand K Bewoor& Vinay A Kulkarni, Metrology & Measurement, 15/e, McGrawHill, 2015.
5. 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_2B.pdf
- https://www.digimat.in/nptel/courses/video/112104250/L47.html
- https:/www.digimat.in/nptel/courses/video/112106138/L01.html
- https://www.digimat.in/nptel/courses/video/112106179/L01
- html https://www.youtube.com/watch?v=tczyyM4Dykc
- https://www.youtube.com/watch?v=_UsAiZmRC1M
- https://www.youtube.com/watch?v=oCkaxI19X8

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B.Tech. III Year I Semester

Introduction to Quantum Technologies and Applications
(Qualitative Treatment)

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	REG	Course Type
23A0522T	3:0:0	3	CIE:30 SEE:70	3Hours	RG23	ES

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

- 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

Syllabus		TotalHours:36
Unit–I	**Introduction to Quantum Theory and Technologies**	**8 Hrs**

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–II	**Theoretical Structure of Quantum Information Systems**	**7 Hrs**

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–III	**Building a Quantum Computer – Theoretical Challenges and Requirements**	**7 Hrs**

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-IV	**Quantum Communication and Computing – Theoretical Perspective**	**7 Hrs**

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- V	Applications, Use Cases, and the Quantum Future	7 Hrs
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		

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

- 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

Text Books:

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:

- https://quantum.ibm.com/
- https://www.coursera.org/learn/quantum-mechanics
- https://www.udemy.com/course/quantum-physics/?campaigntype=Search&portfolio=Bing-India&language=EN&product=Course&test=&audience=Keyword&topic=Quantum_Mechanics_%28physics%29&priority=Gamma&matchtype=b&couponCode=PMNVD2025
- https://www.youtube.com/playlist?list=PL1826E60FD05B44E4
- https://github.com/RafeyIqbalRahman/Qiskit-Textbook

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B.Tech. III Year I Semester

Tool Design (Professional Elective-I)						
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**REG**	**Course Type**
23A0318Ta	**3:0:0**	**3**	**CIE:30 SEE:70**	**3Hours**	**RG23**	**PE-I**

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

- Understand the fundamentals of tool engineering and the role of tool design in manufacturing.
- Analyze the principles of metal cutting and apply them to cutting tool design.
- Design various jigs and fixtures using proper locating and clamping principles.
- Evaluate and design different types of press tool dies for sheet metal operations.
- Develop tooling and fixture strategies suitable for CNC machining systems.

Syllabus		**TotalHours:36**
Unit–I	**Introduction to Tool Design**	**8 Hrs**
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**	**7 Hrs**
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**	**7 Hrs**
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**	**7 Hrs**
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**	**7 Hrs**
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.		

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

- Understand tool design fundamentals, select appropriate materials, and design effective tools to develop durable, precise tools for various manufacturing applications.

- Define Oblique and orthogonal cutting **,** Apply the mechanics of metal cutting to design basic cutting tools like single-point, milling, and broaching tools.
- Demonstrate basic principles of drill jigs and various fixtures and design the jigs and fixtures by applying principles of location and clamping.
- Calculate clearance, cutting forces, and develop designs for press tool dies (blanking, piercing, bending, and drawing).
- Evaluate and Develop CNC machine tools. tool holding, fixture systems, and automation features like ATC for CNC machine tools.

Text Books:

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,11/e, 2019.
2. Prakash Hiralal Joshi, Tooling data, Wheeler Publishing, 2000
3. Venkataraman K., Design of Jigs, Fixtures and Press tools, TMH, 2005.

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/#

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B.Tech. III Year I Semester

Automobile Engineering **(Professional Elective-I)**					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0318Tb	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE-I**

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

- Impart the knowledge on I C Engine, Automobile chasis and Body
- Demonstrate fuel systems and types of ignitions systems.
- Explain the Principles of Steering system and Suspension system.
- Gain knowledge wheels, Tyres and Braking system.
- Make the students with the awareness on Automobile electrical system.

Syllabus		**Total Hours:36**
Unit-I	**Introduction to vehicle structure and engine components**	**8Hrs**
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**	**7Hrs**
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**	**7Hrs**
Davis and Ackerman steering, condition for correct steering, 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**	**7Hrs**
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**	**7Hrs**
Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program(ESP), Traction Control System (TCS) - Fuel Cell.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Classify different types of engine cylinder arrangements and their applications in the automotive industry.
- Demonstrate the operation of various lubrication systems used in internal combustion engines.
- Solve common problems in ignition and fuel supply systems using diagnostic tools and techniques.
- Interpret steering geometry and its impact on vehicle handling and stability.

- Use knowledge of tyre specifications and brake types to select appropriate components for different vehicle applications.
- Illustrate how advanced electrical systems, such as ABS and ESP, improve vehicle safety and performance.

Text Books:

1. Kirpal Singh, Automobile Engineering, Vol.1&2, Standard Publications, 13/e, 2020.
2. David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, 2009.

Reference Books:

1. William.H.Crouse, Automotive Mechanics, 10/e , McGraw-Hill, 2006.
2. Joseph Heitner, Automotive Mechanics Principles and Practices, 2/e, CBS publishing 2004.
3. K. Newton and W. Steeds, The motor vehicle, 13/e, Butterworth-Heinemann Publishing Ltd, 2001.
4. Richard Stone, Jeffrey K. Ball, Automotive Engineering Fundamentals" SAE International, 2004.
5. Bosch, Automotive Hand Book, 6/e, SAE Publications, 2007.

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

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B.Tech. III Year I Semester

Mechanical Behaviour of Materials
(Professional Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0318Tc	3:0:0	3	CIE:30 SEE:70	3 Hours	PE-I

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

- Explain the structure of material over the effects of mechanical properties.
- Familiarize the defects inside the structure and their effects on the mechanical properties.
- Train the methods for characterization of the mechanical behavior of materials.
- Impart knowledge about strengthening mechanisms of materials.
- Teach mechanisms of failures of materials (fracture, fatigue and creep) and their relationship with the different types of stress.

Syllabus		Total Hours:42
Unit-I	**Elastic and plastic behaviour**	**9Hrs**
Elastic behaviour of materials – Hooke‘s law, plastic behaviour: 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**	**9Hrs**
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**	**8Hrs**
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 KIC.		
Unit-IV	**Fatigue behaviour and testing**	**8Hrs**
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 behaviour and testing**	**8Hrs**
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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Dictate the elastic behaviour of engineering materials, recall Hooke‘s law and apply the dislocation theory, forces on and between dislocations.
- Apply dispersion strengthening and fibre strengthening mechanisms, differentiate strain aging and dynamic strain aging and create grain size strengthening and solid solution strengthening
- 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.
- Explain fatigue behaviour and testing. Discuss the factors affecting fatigue. Apply fracture mechanics in design.

- Identify and describe various structural changes during creep. Evaluate and predict the metallurgical factors affecting creep and creep different testing.

Text Books:

1. Marc André Meyers and Krishan Kumar Chawla, Mechanical Behavior of Materials, Cambridge University Press, 2/E, 2008
2. Norman E. Dowling, Stephen L. Kampe, and Milo V. Kral, Mechanical Behavior of Materials, Pearson, 5/E, 2018

Reference Books:

1. Ferdinand Beer, E. Russell Johnston Jr., John DeWolf, and David Mazurek , Mechanics of Materials, McGraw-Hill Education, 7/E, 2014
2. William D. Callister Jr. and David G. Rethwisch , Materials Science and Engineering: An Introduction, Wiley, 10/E, 2018
3. David R. Gaskell and David E. Laughlin, Introduction to the Thermodynamics of Materials, CRC Press, 6/E, 2017

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= ULCr6KGQwMP XhNC2
- https://youtube.com/playlist?list=PL-g1KbXtGBBvF3G4lQuY0zSGBFHh4-5kF&si=47R1eQ_zAWcO-9A

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B.Tech. III Year I Semester

Work Study and Ergonomics
(Professional Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0318Td	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE-I**

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

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

Syllabus		Total Hours:36
Unit-I	**Productivity and Work Study**	**8Hrs**

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 & Work Measurement**	**7Hrs**

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: Cycle graph and Chrono cycle 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**	**7Hrs**

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	**Ergonomics**	**7Hrs**

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	7Hrs

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Recollect the basic concepts of productivity, work content and work study and define the objective and scope of Work Study.
- 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.
- 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
- Determine the basic concepts of Ergonomics and demonstrate a sound knowledge of Ergonomics in engineering applications.
- Demonstrate a sound knowledge of Man-Machine Interfaces and design of displays and controls in engineering systems

Text Books:

1. Lakhwinder Pal Singh, Work Study and Ergonomics, Cambridge University Press, 1st Edition, 2019.
2. K.C. Jain, P.L. Verma, and Nitin Shrivastava, Work Study and Ergonomics, New Age International Publishers, 2018.

Reference Books:

1. P.C. Tewari, Work Study and Ergonomics, Routledge, Ane Books Pvt. Ltd., 1st Edition, 2018.
2. S. Dalela and Sourabh, Work Study and Ergonomics. Standard publishers 2013
3. S.K. Sharma and Savita Sharma, Work Study & Ergonomics, S.K. Kataria & Sons,2016.
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

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B.Tech. III Year I Semester

Nano Technology
(Professional Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0318Te	3:0:0	3	CIE:30 SEE:70	3 Hours	PE-I

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

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

Syllabus		Total Hours:36
Unit-I	**Properties of Materials**	**8Hrs**

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**	**7Hrs**

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	**Characterization Techniques**	**7Hrs**

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

Unit-IV	**Carbon Nano Technology**	**7Hrs**

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**	**7Hrs**

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

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Apply mechanical properties of nanomaterials within material science to evaluate size reduction effects.
- Analyze electrical properties of nanostructures in nanotechnology to compare synthesis techniques.
- Evaluate thermal properties of nano materials in energy applications to recommend optimization strategies.
- Analyze dielectric properties of nano structures in opto-electronic applications to identify characterization techniques.
- Apply magnetic properties of nanomaterials in biology to design innovative medical devices.
- Analyze opto-electronic properties of quantum dots in surface science to assess performance improvements.

Text Books:

1. M.S Ramachandra Rao, Shubra Singh, Nano science and nano technology, Wiley publishers,2013.
2. Risal Singh, Shipra Mital Gupta, Introduction to Nanotechnology , Oxford Higher Education, First Publication 2016.

Reference Books:

3. Charles P. Poole, Jr., Frank J.Owens , Introduction to Nano Technology, Wiley publishers,2003.
4. Jermy J Ramsden, Nanotechnology, Elsevier publishers (2015)
5. A.K.Bandyopadhyay, Nano Materials, New Age, 2007.
6. T.Pradeep, Nano The Essentials, , McGrawHill, 2014
7. M.A Shah, K.A Shah ,Nanotechnology the Science of Small, Wiley Publishers,2019.

Online Learning Resources:

- https://youtube.com/playlist?list=PLyqSpQzTE6M8682dGkNTN8936vSY4CbqZ&si=8S682KjXK7_xITpT
- https://youtu.be/OLa8DQkKlyU?si=I6R1Of59MArQyPUb
- https://youtu.be/u1ojNgPCHGs?si=mlIgQm4OdwZnHUo3

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B.Tech. III Year I Semester

Thermal Engineering Lab					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0320P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- To impart knowledge on working principles of various thermal equipments like compressors, IC Engines, Boilers etc.
- 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	**Total Hours:36**

List of Experiments: (Conduct any 10 experiments in the below listed 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
13. Heat Pipe Demonstrator: Demonstration of isothermal characteristics exhibited by a heat pipe in comparison to other pipes.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Illustrate valve/port timing diagrams of I.C. engines, aligning with Bloom's examine level.
- Assess performance of 4-stroke diesel engines, aligning with Bloom's evaluate level.
- Compare performance of 2-stroke petrol engines, aligning with Bloom's examine level.
- Justify engine friction evaluation via Morse test on 4-stroke multi-cylinder engines, aligning with Bloom's evaluate level.
- Inspect retardation and motoring test results on 4-stroke engines, aligning with Bloom's evaluate level.
- Categorize heat balance components of I.C. engines, aligning with Bloom's analyze level.

Online Learning Resources:

- https://www.youtube.com/watch?v=i4SF47hjnjQ&list=PL0AQx5JlTK3WUCXXkA9Hev3FFLz4sESSg
- https://www.youtube.com/watch?v=B-rFIdOiNo&list=PLkUEX3IbW7lfdC2ieft_9 FH5zAAvUfZAn

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B.Tech. III Year I Semester

Dynamics Lab					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0321P	**0: 0: 3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

Syllabus	**Total Hours:36**

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.
13. Determine the gyroscopic couple on a motorized gyroscope and compare it with the theoretically applied couple.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Ability to demonstrate the principles of kinematics and dynamics of machinery
- Determine the Mass moment of inertia, Range sensitivity.
- Drawing of Cam profile, determination of torsional, undamped and damped natural frequencies.
- Determining of influence of coefficient and balancing of rotating , reciprocating masses.
- Verify the laws of springs and forced vibration of cantilever beam.

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B.Tech. III Year I Semester

Machine Tools & Metrology lab					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0322P	**0: 1: 2**	**2**	**CIE:30 SEE:70**	**3 Hours**	**SEC**

Course Objectives:

- To understand the parts of various machine tools and about different shapes of products that can be produced on them.
- To measure bores, angles and tapers
- To perform alignment tests on various machines

List of Experiments	**Total Hours:36**

Note: The students have to conduct at least 5 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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Perform machining operations on a lathe.
- Perform indexing to machine spur gears on milling machine.
- Evaluate internal and external taper angles, straightness and flatness of a given surface.
- Evaluate dimensional and form accuracies of thread and gear profiles.

Online Learning Resources:

- https://www.youtube.com/watch?v=sG6GCfX7L3c&pp=ygUeTWFjaGluZSBUb29scyAgbGFiIGV4c GVyaW1lbnRz
- https://www.youtube.com/watch?v=mafthRhz1iM&pp=ygUeTWFjaGluZSBUb29scyAgbGFiIGV4cG VyaW1lbnRz
- https://www.youtube.com/watch?v=5--saq-oYBE&list=PLrcSDk_gQ7jiQCfWEzw93ZMaxHkg2vCC
- https://www.youtube.com/watch?v=m60m2TcbTgc&pp=ygUZbWV0cm9sb2d5IGxhYiBleHBlcmltZ W50cw%3D%3D

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B.Tech. III Year I Semester

Tinking Lab					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0420P	**2: 0: 0**	**1**	**CIE:30 SEE:70**	**3 Hours**	**ES**

Course Objectives:

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.

- Encourage Innovation and Creativity
- Provide Hands-on Learning and Impart Skill Development
- Foster Collaboration and Teamwork
- Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
- 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	**Total Hours:16**

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.

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B.Tech. III Year I Semester

Community Service Project Experiential learning through community engagement				
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Course Type**
23A0323	**0: 0: 0**	**2**	**SEE:50**	**PR**

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.

1. Agriculture
2. Health
3. Marketing and Cooperation
4. Animal Husbandry
5. Horticulture
6. Fisheries
7. Sericulture
8. Revenue and Survey
9. Natural Disaster Management
10. Irrigation
11. Law & Order
12. Excise and Prohibition
13. Mines and Geology
14. Energy
15. Internet
16. Free Electricity
17. 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 –
    - 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

Role of Students:

1. Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
2. For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
3. As and when required the College faculty themselves act as Resource Persons.
4. 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.
5. 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.
6. 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.

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B.Tech. III Year I Semester

Green Buildings
(Common to all branches of Engineering)
(Open Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0148T	3:0:0	3	CIE:30 SEE:70	3 Hours	OE-I

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

- To understand the fundamental concepts of green buildings, their necessity, and sustainable features.
- To Analyse green building concepts, rating systems, and their benefits in India.
- To apply green building design principles, energy efficiency measures, and renewable energy sources.
- To evaluate air conditioning systems, HVAC designs, and energy modeling for sustainable buildings.
- To assess material conservation strategies, waste management, and indoor environmental quality in green buildings.

Syllabus		Total Hours:36
Unit-I	**Introduction to Green Building**	**8Hrs**
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**	**7Hrs**
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**	**7Hrs**
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**	**7Hrs**
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**	**7Hrs**
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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- **Understand** the importance of green buildings, their necessity, and sustainable features.

- **Analyze** various green building practices, rating systems, and their impact on environmental sustainability.
- **Apply** principles of green building design to enhance energy efficiency and incorporate renewable energy sources.
- **Evaluate** HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.
- **Assess** material conservation techniques, waste reduction strategies, and indoor air quality management in green buildings.

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.

Reference 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/**

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B.Tech. III Year I Semester

Construction Technology and Management
(Common to all branches of Engineering)
(Open Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0149T	3:0:0	3	CIE:30 SEE:70	3 Hours	OE-I

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

- To understand project management fundamentals, organizational structures, and leadership principles in construction.
- To Analyse manpower planning, equipment management, and cost estimation in civil engineering projects.
- To apply planning, scheduling, and project management techniques such as CPM and PERT.
- To evaluate various contract types, contract formation, and legal aspects in construction management.
- To assess safety management practices, accident prevention strategies, and quality management systems in construction.

Syllabus		Total Hours:36
Unit-I	**Introduction to Project Management**	**8Hrs**
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	**Planning of Man power and Machine**	**7Hrs**
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 and Project Management**	**7Hrs**
Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network- formulation and Time Computation.		
Unit-IV	**Contracts**	**7Hrs**
Types of Contracts, formation of Contract – Contract Conditions – Contract for Labour, 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**	**7Hrs**
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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand project management fundamentals, organizational structures, and leadership principles in construction.
- Analyse manpower planning, equipment management, and cost estimation in civil engineering projects.

- Apply planning, scheduling, and project management techniques such as CPM and PERT.
- Evaluate various contract types, contract formation, and legal aspects in construction management.
- Assess safety management practices, accident prevention strategies, and quality management systems in construction.

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.

Reference 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/

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B.Tech. III Year I Semester

Electrical Safety Practices and Standards
(Common to All Branches of Engineering Except EEE)
(Open Elective-I)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0222T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE-I

Course Objectives:

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

- To impart knowledge on fundamentals of electrical safety, hazards of electricity, shocks, arc and blast, and preventive safety requirements.
- To familiarize students with various safety components such as conductors, insulators, voltage classifications, over-voltage protection, static electricity protection, electrical safety equipment, and fire extinguishers.
- To explain grounding and bonding concepts including system and equipment grounding, earthing practices, safe approach distances, and arc hazard categorization.
- To develop awareness on electrical safety practices, first aid, and safe handling of electrical tools, with applications in railways, swimming pools, lighting systems, and medical installations through case studies.
- To provide knowledge of standards, codes, rules, and statutory requirements related to electrical safety, including national and international standards.

Syllabus		Total Hours: 36Hrs
Unit-I	**Introduction To Electrical Safety**	**8Hrs**
Fundamentals of Electrical safety-Electric Shock- physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.		
Unit-II	**Safety Components**	**7Hrs**
Introduction to conductors and insulators- voltage classification -safety against over voltages- safety against static electricity-Electrical safety equipment's - Fire extinguishers for electrical safety.		
Unit -III	**Grounding**	**7Hrs**
General requirements for grounding and bonding- Definitions- System grounding-Equipment grounding - The Earth - Earthing practices- Determining safe approach distance-Determining arc hazard category.		
Unit -IV	**Safety Practices**	**7Hrs**
General first aid- Safety in handling hand held electrical appliances tools- Electrical safety in train stations- swimming pools, external lighting installations, medical locations-Case studies.		
Unit -V	**Standards For Electrical Safety**	**7Hrs**
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 electrical inspectorate.		

Course Outcomes(CO): After the completion of the course students will able to:

- Understanding the Fundamentals of Electrical Safety
- Identifying and Applying Safety Components
- Analyzing Grounding Practices and Electrical Bonding

- Applying Safety Practices in Electrical Installations and Environments
- Evaluating Electrical Safety Standards and Regulatory Compliance

Textbooks:

1. Massimo A.G.Mitolo, Electrical Safety of Low-Voltage Systems, McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi, Electric Safety - Practice and Standards, CRC Press, USA, 2014

Reference Books:

1. Kenneth G.Mastrullo, Ray A. Jones, The Electrical Safety Program Book, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, Electrical Safety-Related Work Practices‖, Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W., Electrical Safety Engineering, Butterworth and Company, London, 1993.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, Electrical Safety Hand book, McGraw-Hill, New York, USA, 4th edition, 2012

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B.Tech. III Year I Semester

Electronic Circuits
(Common To All Branches of Engineering Except ECE)
(Open Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0442T	3:0:0	3	CIE:30 SEE:70	3 Hours	OE-I

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

- To understand semiconductor diodes, their characteristics and applications.
- To explore the operation, configurations, and biasing of BJTs.
- To study the operation, analysis, and coupling techniques of BJT amplifiers.
- To learn the operation, applications and uses of feedback amplifiers and oscillators.
- To analyze the characteristics, configurations, and applications of operational amplifiers.

Syllabus		Total Hours:36
Unit-I	**Semiconductor Diode and Applications**	**8Hrs**

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)**	**7Hrs**

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 & Multistage amplifiers**	**7Hrs**

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 & Oscillators**	**7Hrs**

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, Crystal Oscillator.

Unit-V	**Op-amp and Application**	**7Hrs**

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

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand semiconductor diodes, their characteristics.
- Understand semiconductor devices applications as Rectifiers and Clipping circuits
- Explore the operation, configurations, and biasing of BJTs.
- Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
- Learn the operation, applications and uses of feedback amplifiers and oscillators.
- Analyze. the characteristics, configurations, and applications of operational amplifiers

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.

Online Learning Resources:

- https://archive.nptel.ac.in/courses/105/104/105104161/
- https://archive.nptel.ac.in/courses/105/103/105103093/

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B.Tech. III Year I Semester

Java Programming
(Common to all branches of Engineering except CSE & allied)
(Open Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0545T	3:0:0	3	CIE:30 SEE:70	3 Hours	OE-I

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

- 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 apis for program development

Syllabus		Total Hours:36
Unit-I	Object Oriented Programming	8Hrs

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, Objects & Methods	7Hrs

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, Inheritance, Interfaces	7Hrs

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 Class Object 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, Java Library, Exception Handling, Java I/O and File**	**7Hrs**
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 Auto un boxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java. .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 Throw able, 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, Multithreaded Programming, Java FX GUI**	**7Hrs**
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 My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set 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)		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
- Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects
- Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.
- Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
- Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.
- Choose appropriate data structure of Java to solve a problem

Text Books:

1. Anitha Seth, B.L. Juneja, JAVA one step ahead, Oxford.
2. Debasis Samanta, Monalisa Sarma, Joy with JAVA, Fundamentals of Object Oriented Programming, Cambridge, 2023.
3. Paul Deitel, Harvey Deitel, JAVA 9 for Programmers, 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:

- https://nptel.ac.in/courses/106/105/106105191/
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347 _shared/overview

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B.Tech. III Year I Semester

Fundamentals of Artificial Intelligence
(Common to all branches of Engineering except CSE allied)
(Open Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0546T	3:0:0	3	CIE:30 SEE:70	3 Hours	OE-I

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

- 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.

Syllabus		Total Hours:36
Unit-I	**Introduction to AI**	**8Hrs**

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, Logic**	**7Hrs**

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 & Knowledge Representation**	**7Hrs**

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**	**7Hrs**

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	**Probabilistic Reasoning**	**7Hrs**

Probabilistic Reasoning: 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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- 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

Text Books:

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.

Online Learning Resources:

- https://ai.google/
- https://swayam.gov.in/nd1_noc19_me71/preview

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B.Tech. III Year I Semester

Quantum Technologies and Applications (Open Elective-I)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0547T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OE-I**

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

- 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.

Syllabus		**Total Hours:36**
Unit-I	**Fundamentals of Quantum Mechanics**	**8Hrs**

- 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**	**7Hrs**

- 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**	**7Hrs**

- Teleportation & No-Cloning
- BB84 Protocol
- Quantum Networks & Repeaters
- Classical vs Quantum Cryptography
- Challenges in Implementation

Unit-IV	**Quantum Sensors and Metrology**	**7Hrs**

- Quantum Sensing: Principles and Technologies
- Quantum-enhanced Measurements
- Atomic Clocks, Gravimeters
- Magnetometers, NV Centers
- Industrial Applications

Unit-V	**Quantum Materials and Emerging Technologies**	**7Hrs**

- Quantum Materials: Superconductors, Topological Insulators
- Quantum Devices: Qubits, Josephson Junctions
- National Quantum Missions (India, EU, USA, China)
- Quantum Careers and Industry Initiatives

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- 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.

Text Books:

1. Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang (Cambridge University Press)
2. Quantum Mechanics: The Theoretical Minimum" by Leonard Susskind and Art Friedman (Basic Books)

Reference Books:

1. Quantum Computing for Everyone" by Chris Bernhardt (MIT Press)
2. Quantum Physics: A Beginner's Guide" by Alastair I.M. Rae
3. An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca
4. IBM Quantum Experience and Qiskit Documentation (https://qiskit.org/)

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B.Tech. III Year I Semester

Mathematics for Machine Learning and AI (Open Elective-I)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0027T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OE-I**

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

- 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.

Syllabus		**Total Hours:36**
Unit-I	**Linear Algebra for Machine Learning**	**8Hrs**
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**	**7Hrs**
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**	**7Hrs**
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**	**7Hrs**
Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.		
Unit-V	**Graph Theory for AI**	**7Hrs**
Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Apply linear algebra concepts to ML techniques like PCA and regression.
- Analyze probabilistic models and statistical methods for AI applications.
- Implement optimization techniques for machine learning algorithms.
- Utilize vector calculus and transformations in AI-based models.
- Develop graph-based AI models using mathematical representations.

Text Books:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learning by 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

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B.Tech. III Year I Semester

Materials Characterization Techniques (Open Elective-I)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0034T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OE-I**

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

- To provide exposure to different characterization techniques.
- To explain the basic principles and analysis of different spectroscopic techniques.
- To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
- To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
- To educate the uses of advanced electric and magnetic instruments for characterization.

Syllabus		**Total Hours:36**
Unit-I	**Structure analysis by Powder X-Ray Diffraction**	**8Hrs**
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 Xray scattering (SAXS) (in brief).		
Unit-II	**Microscopy technique -1 –Scanning Electron Microscopy (SEM)**	**7Hrs**
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)**	**7Hrs**
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**	**7Hrs**
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**	**7Hrs**
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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Analyze the crystal structure and crystallite size by various methods
- Analyze the morphology of the sample by using a Scanning Electron Microscope
- Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope
- Explain the principle and experimental arrangement of various spectroscopic techniques

- Identify the construction and working principle of various Electrical & Magnetic Characterization technique

Text Books:

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 :

- https://nptel.ac.in/courses/115/103/115103030/
- https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
- https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

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B.Tech. III Year I Semester

Chemistry of Energy Systems
(Open Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0040T	3:0:0	3	CIE:30 SEE:70	3 Hours	OE-I

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

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
- Necessarily of harnessing alternate energy resources such as solar energy and its basic concepts.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

Syllabus		Total Hours:36
Unit-I	**Electrochemical Systems**	**8Hrs**

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-II	**Fuel Cells**	**7Hrs**

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-III	**Photo and Photo electrochemical Conversions**	**7Hrs**

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-IV	**Solar Energy**	**7Hrs**

Solar Energy: Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

Unit-V	**Hydrogen Storage**	**7Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Solve the problems based on electrode potential, Describe the Galvanic Cell
- Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
- 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
- Differentiate between Photo and Photo electrochemical Conversions,
- Illustrate the photochemical cells, Identify the applications of photochemical reactions,

- Interpret advantages of photoelectron catalytic conversion.
- Apply the photo voltaic technology, Demonstrate about solar energy and prospects
- Illustrate the Solar cells, Discuss about concentrated solar power
- 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.

Text Books:

1. Ira N. Levine, Physical Chemistry, McGraw Hill Education, 7th Edition, 2013.
2. A. Bahl, B. S. Bahl, G. D. Tuli, Essentials of Physical Chemistry, S. Chand & Company Ltd., 25th Edition (Revised), 2011.
3. Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, Fraser Armstrong (commonly cited as Atkins & Overton et al.), Shriver & Atkins' Inorganic Chemistry, Oxford University Press, 6th Edition, 2014.

Reference Books:

1. U.S. Department of Energy, EG&G Technical Services, Inc., Fuel Cell Handbook, U.S. Department of Energy, 7th Edition, 2004.
2. Arvind Tiwari, Shyam, Handbook of Solar Energy and Applications, Narosa Publishing House, 1st Edition, 2009.
3. Klaus Jäger, Oliver Brendel, Holger Lux Steiner, Lutz Treiber, Wolfram Warta (et al.), Solar Energy: Fundamentals, Technology and Systems, Wiley VCH, 1st Edition, 2016.
4. Philip L. Klebanoff (edited by, Sandia National Laboratories, U.S. DOE), Hydrogen Storage Technology: Materials and Applications, CRC Press (Taylor & Francis), 1st Edition, 2012.

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B.Tech. III Year I Semester

English for Competitive Examinations
(Open Elective-I)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0044T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OE-I**

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

- To enable the students to learn about the structure of competitive English
- To understand the grammatical aspects and identify the errors
- To enhance verbal ability and identify the errors
- To improve word power to answer competitive challenges
- To make them ready to crack competitive exams

Syllabus		**Total Hours:36**
Unit-I	**GRAMMAR-1**	**8Hrs**
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**	**7Hrs**
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**	**7Hrs**
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**	**7Hrs**
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**	**7Hrs**
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		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Identify the basics of English grammar and its importance.
- Explain the use of grammatical structures in sentences.
- Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams
- Analyze an unknown passage and reach conclusions about it.

- Choose the appropriate form of verbs in framing sentences.
- Develop speed reading and comprehending ability thereby perform better in competitive exams

Text Books:

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.

Web References:

- https://www.grammar.cl/english/parts-of-speech.htm
- https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech
- https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passivevoice
- https://languagetool.org/insights/post/verb-tenses/
- https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council
- https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx

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B.Tech. III Year I Semester

Entrepreneurship and New Venture Creation (Open Elective-I)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0051T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OE-I**

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

- To foster an entrepreneurial mind-set for venture creation and intrapreneurial leadership.
- To encourage creativity and innovation
- To enable them to learn pitching and presentation skills
- To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept.
- To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

Syllabus		**Total Hours:36**
Unit-I	**Entrepreneurship Fundamentals and context**	**8Hrs**

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

Unit-II	**Problem & Customer Identification**	**7Hrs**

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.

Unit-III	**Solution design, Prototyping & Opportunity Assessment and Sizing**	**7Hrs**

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

Unit-IV	**Business & Financial Model, Go-to-Market Plan**	**7Hrs**

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.

Unit-V	**Scale Outlook and Venture Pitch readiness**	**7Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship
- Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution
- Analyze and refine business models to ensure sustainability and profitability
- Build Prototype for Proof of Concept and validate MVP of their practice venture idea
- Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture
- Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders

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).

Reference Books:

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.

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COURSE STRUCTURE AND SYLLABUS
UNDER B Tech ME- RG 23 REGULATIONS

III YEAR II SEMESTER

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M1. To Impart comprehensive knowledge and experience in Mechanical Engineering domain through the effective implementation of Teaching-Learning methodologies

M2. To promote the culture of Interdisciplinary learning and facilitate Industrial training to resolve global Engineering issues

M3. To Impart training on modern drafting and analysis software sharpening computational capabilities and promoting higher studies

M4. To Initiate Industry-Institute Interface facilitating skill enhancement keeping pace with emerging industrial trends by Infusing ethical values

Program Educational Outcomes

PE01. Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PE02. Pursue successful professional career in industry, academia or research.

PE03. Engage in continuous learning to keep abreast with emerging technologies with the sense of professional ethics.

PE04. Contribute in multi-disciplinary teams through effective interpersonal skills

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Utilize the knowledge of materials and manufacturing principles to plan, design and monitor the production operations of an Industry.

PSO2: Employ the governing laws of thermodynamics, heat transfer and refrigeration & air-conditioning to design and develop thermo-fluid system.

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B.Tech. III Year II Semester (Theory-6, Lab-2, SEC-1, MC-1)

S.No.	Course Code	category	Course Name	L	T	P	Credits
1.	PC	23A0324T	Heat Transfer	3	0	0	3
2.	PC	23A0325T	CAD/CAM	3	0	0	3
3.	PC	23A0326T	Theory of machines	2	1	0	3
4.	PE	-	**Professional Elective-II**	3	0	0	3
		23A0327Ta	1. Engineering Fracture Mechanics				
		23A0327Tb	2. Introduction of Turbo Machinery				
		23A0327Tc	3. Control Systems				
		23A0327Td	4. Operations Research				
		23A0327Te	5. Smart Materials				
5.	PE	--	**Professional Elective-III**	3	0	0	3
		23A0328Ta	1. Applications of Computational Fluid dynamics				
		23A0328Tb	2. Industrial Safety				
		23A0328Tc	3. Design of Automobile Transmission Systems				
		23A0328Td	4.Mechanics & Manufacturing of Composite Materials				
		23A0328Te	5.Introduction to hybrid and electric vehicles				
6.	OE	---	**Open Elective-II**	3	0	0	3
7.	PC	23A0329P	Heat Transfer Lab	0	0	3	1.5
8.	PC	23A0330P	CAD/CAM Lab	0	0	3	1.5
9.	SEC	23A0331	**Skill Enhancement course** 3 D Printing Lab	0	1	2	2
10	MC	23A0053T	**Audit Course** Technical paper writing and IPR	2	0	0	0
11	MC	23A0332	**Workshop**	0	0	0	0
			Total	19	2	08	23
Mandatory Industry Internship of 6-8 weeks duration during summer vacation							

Category	**Credits**
Professional Core (PC)	12
Professional Elective (PE)	06
Open Elective (OE)	03
Skill Enhancement Course (SEC)	02
Mandatory course (MC)	00
Total	23

Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23A0150T	Disaster Management	CIVIL
2.	23A0151T	Sustainability In Engineering Practices	
3.	23A0232T	Renewable Energy Sources	EEE
4.	23A0443T	Digital Electronics	ECE
5.	23A0548T	Fundamentals of Operating system	CSE & Allied
6.	23A0529T	Machine Learning	
7.	23A0030T	Optimization Techniques	Mathematics
8.	23A0029T	Mathematical Foundation of Quantum Technologies	
9.	23A0035T	Physics of Electronic Materials and Devices	Physics
10.	23A0041T	Chemistry of Polymers and Applications	Chemistry
11.	23A0045T	Academic Writing and Public Speaking	Science and Humanities

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B.Tech. III Year II Semester

Heat Transfer					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0324T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

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

- Understand the concept of heat transfer mechanisms, focusing on steady and unsteady state heat conduction, include practical applications.
- 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.
- Knowledge on the mechanisms and regimes of boiling and condensation, emphasizing the heat transfer characteristics and practical implications of each.
- Design and analysis of various types of heat exchangers, including performance evaluation using LMTD and NTU methods.
- Demonstrate the principles of thermal radiation and mass transfer, including fundamental laws, radiation exchange, and diffusion mechanisms in gases and liquids.

Syllabus		Total Hours:42
Unit – I	**Introduction and Unsteady State Heat Transfer Conduction**	**9 Hrs**

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**	**9Hrs**

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**	**8 Hrs**

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

Unit - IV	**Heat Exchangers**	**8 Hrs**

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 & Mass Transfer**	**8 Hrs**

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.
Introduction to Mass Transfer

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Analyze and solve heat conduction problems in various systems, including steady and transient conditions, using appropriate mathematical models and charts.
- Evaluate convective heat transfer in various systems by applying boundary layer theory and empirical correlations for practical engineering problems.
- Analyze and distinguish between different boiling regimes and condensation modes, and solve related heat transfer problems in engineering applications.
- Design and evaluation different heat exchanger configurations, by analysing appropriate methods.
- Apply radiation laws and mass transfer principles to analyze and solve problems involving radiative heat exchange and diffusive transport in engineering systems

Text Books:

1. Cengel. A.Yunus, Heat Transfer- A Practical Approach, 4/e, Tata McGraw-Hill, 2007.
2. P.K. Nag, Heat Transfer, 3/e, Tata McGraw-Hill, 2011.
3. J.P.Holman, Heat Transfer, 9/e, Tata McGraw-Hill, 2008.
4. 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. S.P. Sukhatme, A Text book of Heat Transfer, Universities Press, 2005.
3. S. C. Arora& S. Domkundwar , A Course in Heat and Mass Transfer, Dhan pat Rai & CO.(P) LTD-Delhi , 2007.
4. C.P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer data book, New Age Publications, 2014.

Online Learning Resources:

- https://ocw.mit.edu/courses/mechanical-engineering/2-051-introduction-to-heattransfer-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

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B.Tech. III Year II Semester

CAD/CAM					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0325T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

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

- Understand the basic of CAD/CAM. Explore graphics standards and analyze 2D and 3D geometric transformations.
- Knowledge and skills to apply various geometric modeling techniques, as well as solid modeling approaches.
- Explain the principles of Computer Aided Manufacturing (CAM), numerical control (NC), and the functionalities of CNC and DNC systems.
- Design and develop a part programming using G/M codes and APT for various machining operations.
- Explain the basics of automation systems, robotics, group technology, CIM, and emerging trends like VR, AR, and AI

Syllabus		Total Hours:36
Unit – I	**Overview of CAD/CAM & Computer Graphics**	**8 Hrs**

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**	**7Hrs**

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 & CNC Part Programming**	**7Hrs**

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 & Computer Aided Quality Control**	**7 Hrs**

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 & Computer integrated production planning	7 Hrs
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.		

Course Outcomes (CO):

Upon completion of this course, students should be able to:

- Utilize CAD and CAM tools effectively in the mechanical engineering industry, focusing on product cycle, evaluation criteria, and database management systems.
- Build proficiency in representation techniques, wire frame, surface, and solid modeling within the mechanical engineering industry.
- Assess NC modes, CNC systems, and part programming fundamentals in the mechanical engineering industry.
- Judge the effectiveness of group technology, FMS components, and CAQC integration in the mechanical engineering industry.
- Implement retrieval and generative process planning techniques in the mechanical engineering industry.
- Integrate capacity planning, MRP systems, and trends like sustainable manufacturing in the mechanical engineering industry.

Text Books:

1. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, Pearson Prentice Hall of India, Delhi, 5/e, 2008.
2. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, Tata McGraw-Hill, Delhi, 2/e, 2009.

Reference Books:

1. P. N. Rao, CAD/CAM: Principles and applications, Tata McGraw-Hill, Delhi,3/e, 2017.
2. P. Radhakrishnan, S. Subramanyan& V. Raju, CAD/CAM/CIM, New Age International Publishers,3/e, 2008.
3. Tien Chien Chang, Computer Aided Manufacturing, Pearson,3/e, 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

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B.Tech. III Year II Semester

Theory of Machines					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0326T	**2: 1: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PCC**

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

- Introduce various basic mechanisms and their applications.
- Explain the importance of Degree of freedom.
- Familiarize velocity and acceleration in mechanisms.
- Describe the cams and follower motions.
- Explain the importance of gyroscopic couples.
- Understand the fundamentals of vibrations, including degrees of freedom, types, damping conditions, and concepts of vibration isolation and transmissibility in single-degree-of-freedom systems.

Syllabus		**Total Hours:42**
Unit – I	**Simple Mechanisms**	**9 Hrs**

Simple Mechanisms: Classification of Mechanisms-Basic kinematic concepts and definitions-Degree of freedom, mobility- Grashof's law, Kinematic Inversions of four bar chain-Description of some common mechanisms like Quick return mechanism, straight line mechanisms.

Unit – II	**Motion analysis & Balancing of rotating masses**	**9 Hrs**

Motion analysis: Velocity and acceleration of simple mechanisms using relative velocity method and instantaneous methods- Coriolis component of acceleration

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

Unit – III	**Cams & Gears**	**8 Hrs**

Cams: Classification of Cams and followers-Terminology and definitions-Displacement diagrams for Simple harmonic motion and Uniform acceleration and retardation motion.

Gears: Involute and Cycloidal gear profiles- gear parameters- fundamental law of gearing-spur gear contact ratio and interference/undercutting- Epicyclic and regular gear train kinematics

Unit - IV	**Turning moment diagrams and Fly wheels, Gyroscope**	**8 Hrs**

Turning moment diagrams and Fly wheels: Turning moment diagrams, I.C.engine-Coefficient of fluctuation of energy- Coefficient of fluctuation of speed-Flywheel and their design

Gyroscope: Principle of Gyroscope- Gyroscopic effect on aeroplane and ship-simple problems

Unit - V	**Vibrations**	**8 Hrs**

Vibrations: Introduction, degree of freedom,-types of vibrations, free/natural vibrations-Damped vibrations-under damped, critically damped and over damped systems-Forced vibrations with and without damping in single degree freedom –Vibration isolation and transmissibility.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand different mechanisms and their inversions
- Calculate velocity and acceleration of different links in a mechanism
- Apply the effects of gyroscopic couple in ships, aero planes and road vehicles.
- Evaluate unbalance mass in rotating machines.
- Analyze free and forced vibrations of single degree freedom systems.

Text Books:

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. V.P. Singh, Mechanical Vibrations by V.P. Singh, Dhanpat Rai & Co., 2001.
5. Norton, R.L., Design of Machinery, An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.

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B.Tech. III Year II Semester

Engineering Fracture Mechanics
(Professional Elective-II)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0327Ta	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Understanding of Engineering Fracture Mechanics (EFM principles and fatigue crack growth models, with a focus on analyzing and preventing spectacular structural failures.
- Explore the principles of crack growth and fracture mechanisms, and their applications in material failure analysis.
- 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).
- 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
- To study fracture toughness testing, crack growth models, analysis, failure assessment diagrams and mixed-mode fracture, along with methods for crack arrest and repair.

Syllabus		Total Hours:42
Unit – I	**Introduction to EFM, LEFM, EPFM, and Fatigue Crack Growth**	**8 Hrs**
EFM Course outline and Spectacular Failures, Introduction to Linear Elastic Fracture Mechanics and Elastic-Plastic Fracture Mechanics , Fatigue Crack Growth Model- Paris' Law and Crack Growth Rates.		
Unit – II	**Crack Growth, Fracture Mechanisms, and Griffith Theory**	**8Hrs**
Crack Growth and Fracture Mechanisms, Griffith TMs Theory of Fracture, Energy Release Rate		
Unit – III	**Elasticity Theory, Westergaard Solution, and K-G Relationship**	**8 Hrs**
Review of Theory of Elasticity , Westergaard Solution for Stress and Displacements for Mode I, Relationship between K and G		
Unit - IV	**Multi-Parameter Stress Fields, SIF, and Plastic Deformation Models**	**9 Hrs**
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 - V	**Fracture Toughness, Paris Law, Crack Growth, and Repair Methods**	**9 Hrs**
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		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Apply LEFM, EPFM, and fatigue crack growth models to assess and prevent catastrophic structural failures at different loads
- Apply Griffith's theory, calculate energy release rates, and analyze crack propagation

mechanisms in materials to predict and prevent fractures in engineering applications.

- 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).
- 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.
- Perform fracture toughness testing, apply crack growth models, and understand crack closure and failure assessment diagrams.

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. T.L. Anderson, Fracture Mechanics-Fundamentals and Applications, 3rd Edition, Taylor and Francis Group, 2005.
2. K. Ramesh, e-Book on Engineering Fracture Mechanics, IIT Madras, 2007.

Online Learning Resources:

- https://nptel.ac.in/courses/112106065
- https://youtube.com/playlist?list=PLA218B83235A4AD5C&si=XI175OWGIvdMCQH9
- https://youtube.com/playlist?list=PLA218B83235A4AD5C&si=ruHP1MIsJGNAyMYV
- https://youtube.com/playlist?list=PLfIFNJ1DPG4ks5AjeCgpbm8nLGM1Pgxer&si=F-fj413KzPAkjPSs

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B.Tech. III Year II Semester

Introduction of Turbo Machinery
(Professional Elective-II)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0327Tb	3:0:0	3	CIE: 30 SEE:70	3 Hours	PE

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

- Understanding of the principles, classifications, and governing equations of turbo machinery.
- 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.
- Principles of similarity analysis and cascade theory in turbo machinery, for performance evaluation of compressor and turbine blades.
- Design and analysis of axial and centrifugal compressors and pumps, considering different parameters.
- 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

Syllabus		Total Hours:42
Unit- I	**Introduction and Classification**	**9Hrs**
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-II	**Gas Turbine Cycle**	**8Hrs**
Gas Turbine Cycle: Brayton Cycle, regenerative cycle, reheat, inter-cooling, turboprop, turbojet and turbofan engine, thrust augmentation and illustrative examples		
Unit-III	**Similarity & Cascade Analysis**	**8Hrs**
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-IV	**Axial Flow Compressor, Centrifugal Pump and Compressor**	**9Hrs**
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-V	**Axial Flow Turbine & Turbomachinery Flows**	**8Hrs**
Axial Flow Turbine: Two-dimensional pitch line design, stage loading capacity, degree of reaction, stage efficiency, turbine performance, blade cooling, and illustrative examples.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- apply the fundamental concepts of fluid motion in rotating systems to design and evaluate the performance of various turbo machines.

- Compare various gas turbine cycles and engine configurations for optimum propulsion and power generation applications.
- Apply similarity principles and cascade analysis techniques to evaluate blade performance, estimate aerodynamic losses, and optimize turbo machine blade designs.
- Design the performance of axial and centrifugal compressors and pumps, and thermodynamic principles for improved efficiency and functionality.
- Evaluate axial flow turbines and apply CFD techniques to simulate and analyze fluid flow and thermal behavior in turbo machinery systems

Text Books:

1. S. L. Dixon and C. A. Hall, Fluid Mechanics and Thermodynamics of Turbomachinery, Butterworth-Heinemann, Seventh Edition, 2014.
2. William W. Peng, Fundamentals of Turbomachinery,Wiley, 2008.

Reference Books:

1. Venkanna B. K, Fundamentals of Turbomachinery, Prentice Hall India Learning Private Limited, 2009.
2. Seppo A. Korpela, Principles of Turbomachinery, John Wiley and Son's, USA, 2nd Edition, 2019.
3. Earl Logan, Jr., Turbomachinery: Basic Theory and Applications,CRC Press, 2003.

Online Learning Resources:

- https://youtube.com/playlist?list=PLbMVogVj5nJQQp3QLuzbcHrt0XncZZTiE&si=ts0mwl6etWcmKO1i
- https://youtube.com/playlist?list=PLWCscP8J8VQ4i0BoPCAgP5mXQh9VWmyuS&si=cLzUxZke5BJV-lUg
- https://youtube.com/playlist?list=PLbMVogVj5nJQQp3QLuzbcHrt0XncZZTiE&si=Rzs-PEl9nqP45rKe

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B.Tech. III Year II Semester

Control Systems (Professional Elective-II)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0327Tc	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Fundamentals of control systems, mathematical modeling, and transfer function derivation for electromechanical components.
- Knowledge on system representation, and to introduce classical control design techniques.
- To equip students with the ability to represent and simplify control, and to design effective controllers for achieving desired system performance.
- Knowledge and skills to analyze control system stability and performance in the frequency domain, using Bode, polar, and transfer functions.
- State-space analysis of different models from block diagrams, and concepts of controllability, observability, and state transition matrices

Syllabus		**Total Hours:42**
Unit-I	**Basics in Control System and Transfer Function**	**9Hrs**

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	**Transfer Function and Control Design Techniques**	**9Hrs**

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 & Stability Analysis**	**8Hrs**

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 & Stability Analysis in Frequency Domain**	**8Hrs**

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	8Hrs

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Model dynamic systems, distinguish between loop controls, analyze feedback effects, and derive transfer functions for DC/AC servo motors and synchro devices.
- Analyze and simplify control systems, and create effective controllers such as lag, lead, lead-lag, and PID to meet system performance specifications.
- Analyze and simplify control systems using block diagrams and signal flow graphs, and design appropriate controllers to achieve desired system performance.
- Analyze the frequency response of control systems using Bode, polar, and evaluate system stability and performance such as gain margin and phase margin.
- Develop state-space models from block diagrams, analyze system controllability and observability, and solve time-invariant state equations using the state transition matrix.

Text Books:

1. I. J. Nagrath, M .Gopal, Control Systems Engineering, 5th edition, New Age International (P) Limited, New Delhi, India, (2011).
2. Benjamin. C. Kuo, Automatic Control Systems, 8th edition, John Wiley and Son's, USA, (2003).

Reference Books:

1. K. Ogata, Modern Control Engineering, 4th edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2008.
2. N. K. Sinha , Control System, New Age International Publishers,3/E, 2008.
3. Prof. Vishwajit K. Barbudhe, Control system Engineering National Press, 2020.
4. Richard Dorf and Robert Bishop Modern Control Systems Pear son, 13th edition, 2016.

Online Learning Resources:

- https://nptel.ac.in/courses/107106081
- https://nptel.ac.in/courses/108107115
- https://nptel.ac.in/courses/108103007
- https://nptel.ac.in/courses/115108104

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B.Tech. III Year II Semester

Operations Research
(Professional Elective-II)

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	REG	Course Type
23A0327Td	3:0:0	3	CIE:30 SEE:70	3Hours	RG23	PE

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

- Understanding of OR, focusing on model classification, formulation, and solution techniques for LP problems.
- Knowledge and techniques for formulating and solving transportation and assignment problems, and the Traveling Salesman Problem.
- Fundamentals of game theory and job sequencing, including optimal strategies, and scheduling techniques.
- 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.
- Familiarize replacement and maintenance strategies, fundamentals of dynamic programming and its applications in optimization problems.

Syllabus — **TotalHours:42**

Unit–I	Introduction to OR	9 Hrs

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	9 Hrs

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	8 Hrs

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	8 Hrs

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	8 Hrs

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.

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

- 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.
- Implement Transportation and Assignment problems to solve the real time industry needs
- Choose the best strategy of Game theory and capable of identifying the suitable techniques .Solve the Job Sequencing Problem.
- Apply different Queuing models to optimize the queuing length. Define the queuing and inventory terminology to solve the different inventory and queuing problems.
- Apply concepts of replacement and maintenance analysis and solve optimization problems using dynamic programming techniques.

Text Books:

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.
3. Khanna O. P, Industrial Engineering and Management, Dhanpat Rai Publishing Co Pvt Ltd,17/e,2018.

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/

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B.Tech. III Year II Semester

Smart Materials (Professional Elective-II)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0327Te	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Fundamental characteristics of different metals and provide an understanding of smart materials, their classification and real-world applications.
- Knowledge of various types of smart materials and electro rheological fluids, and shape memory materials.
- Processing techniques of various smart materials, and smart fluids, with a focus on synthesis and fabrication methods such as metallization and UV curing.
- Understanding of various types of sensors, and advanced sensors such as carbon nanotube and polymer-based sensors.
- Principles, types, and applications of actuators used in smart systems, and electro thermal actuators.

Syllabus		**Total Hours:36**
Unit-I	**Introduction**	**8Hrs**
Characteristics of metals, polymers and ceramics. Introduction to smart materials. Classification of smart materials, Components of a smart System, Applications of smart material.		
Unit-II	**Smart Materials**	**7Hrs**
Smart Materials Piezoelectric materials, Electro strictive Materials, Magnetostrictive materials, Magnetoelectric materials, Magnetorheological Electrorheological fluids, Shape Memory materials.		
Unit-III	**Processing of Smart Materials**	**7Hrs**
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-IV	**Sensors**	**7Hrs**
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-V	**Actuators**	**7Hrs**
Actuators Introduction, Electrostatic transducers, Electromagnetic transducers, Electrodynamic transducers, Piezoelectric transducers, Electro-strictive transducers, Magneto-strictive transducers, Electro thermal actuators, Comparison of actuation, Applications		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- understanding of metals, polymers, ceramics, and smart material characteristics and applications.
- Explain principles and properties of smart materials like piezoelectric and shape memory materials.
- Describe processing techniques for semiconductors, metals, ceramics, and polymers.
- Illustrate mechanisms and applications of sensors like conductometric and piezoelectric.
- Summarize functionality and advantages of actuators like electrostatic and piezoelectric.
- Discuss components and integration of smart systems with sensors and actuators.

Text Books:

1. V. K. Varadan, K. J. Vinoy, S. Gopalakrishnan, Smart Material Systems and MEMS: Design and Development Methodologies, John Wiley and Sons, England, 2006.
2. D. J. Wagg, Smart Materials and Technologies, Artech House, 2007.

Reference Books:

1. A. V. Srinivasan, Smart Structures: Analysis and Design, Cambridge University Press, Cambridge, New York, 2001.
2. P. Gauenzi, Smart Structures, Wiley, 2009.
3. G. Gautschi, Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, Springer, Berlin, New York, 2002.
4. Mohsen Shahinpoor , Intelligent Materials, Royal Society of Chemistry, 2008.
5. H. Janocha, Smart Materials and Intelligent Systems, Springer, 2007.

Web Resources:

- https://nptel.ac.in/courses/112104173/
- www.iop.org/EJ/article/0964-1726/5/3/002/sm6301.ps.gz

MOOCs:

- https://nptel.ac.in/courses/112104173/
- https://nptel.ac.in/courses/112104251/

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B.Tech. III Year II Semester

Applications of Computational Fluid Dynamics
(Professional Elective-III)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0328Ta	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Foundation in numerical techniques, and finite element methods for solving partial differential equations under various boundary conditions.
- Solid understanding of numerical methods for solving time-dependent partial differential equations, with emphasis on stability and accuracy analysis.
- 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.
- 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.
- Understand the concepts of linear fluid flow problems, steady state problems and transient problems.

Syllabus		**Total Hours:42**
Unit-I	**Introduction and Solution methods**	**8Hrs**

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**	**8Hrs**

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 & Treatment of compressible flows**	**8Hrs**

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**	**9Hrs**

Finite Volume Method: Finite volume method via finite difference method, formulations for two and three-dimensional problems

Unit-V	**Standard Variational Methods**	**9Hrs**

Standard Variational Methods: Standard Variational Methods Linear fluid flow problems, steady state problems, Transient problems.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Analyze importance of CFD and its relevance to industry, focusing on finite difference, finite volume, and finite element methods.

- Examine derivation of finite difference equations for governing equations and boundary conditions.
- Compare solution methods of elliptical equations using finite difference formulations and interactive techniques.
- Identify stability analysis techniques for parabolic equations, including explicit and implicit schemes.
- Categorize solution approaches for hyperbolic equations, including explicit and implicit schemes.
- Investigate formulations of incompressible viscous flows using finite difference and pressure correction methods.

Text Books:

1. Hoffman, K.A., and Chiang, S.T., Computational Fluid Dynamics, Vol. I, II and III, Engineering Education System, Kansas, USA, 2000.
2. T.J. Chung, Computational Fluid Dynamics, Cambridge University Press, 2014, 2nd Edition.
3. John D. Anderson, Computational Fluid Dynamics: Basics with applications, Mc Graw Hill. 2017.

Reference Books:

1. Muralidaran, Computational Fluid Flow and Heat Transfer, Narosa Publications, 2003.
2. Tapan K. Sengupta, Fundamentals of Computational Fluid Dynamics, Universities Press, 2004.
3. C. Pozrikidis, Introduction to Theoretical and Computational Fluid Dynamics, Oxford University press 2/e, 2012.
4. Anil W. Date, Introduction to Computational Fluid Dynamics, Cambridge University Press, Year: 2005.
5. Jiri Blazek, Computational Fluid Dynamics: Principles and Applications, Elsevier, Year: 2001.

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

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B.Tech. III Year II Semester

Industrial Safety
(Professional Elective-III)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0328Tb	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Understand the concepts of industrial safety and management.
- Demonstrate the accident preventions and protective equipment.
- Understand and apply the knowledge of safety acts
- knowledge about fire prevention and protection systems
- Understand and apply fire safety principles in buildings

Syllabus		**Total Hours:36**
Unit-I	**Introduction To the Development of Industrial Safety and Management**	**7Hrs**

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**	**7Hrs**

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**	**7Hrs**

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**	**8Hrs**

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**	**7Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Analyze industrial safety history and development within the context of the factories act in the safety management industry.
- Examine personal protective equipment usage and its effectiveness in preventing accidents in the industrial safety sector.
- Compare safety acts (e.g., Factory Act, ESI Act) and their impact on occupational health in the industrial safety field.
- Explain fire prevention techniques and their application in building fire safety within the industrial safety industry.
- Categorize sources of ignition and fire extinguishing agents for effective fire protection in the safety management sector.
- Investigate ergonomic principles and their role in reducing occupational diseases in the industrial safety domain.

Text Books:

1. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall, 2000.
2. Purandare D.D & Abhay D.Purandare, Handbook on Industrial Fire Safety, P&A publications, NewDelhi, 2006.

Reference Books:

1. Dr.A. K.Guptha, Reliability, Maintenance and Safety Engineering, Laxmi Publications, 2011.
2. Alakesh Manna, A Text book of Reliability and Maintenance Engineering, I K International Publishing, 2011.
3. C. Ray Asfahl and David W. Rieske, Industrial Safety and Health Management, Pearson, 2016.
4. Barbara A. Plog and Patricia J. Quinlan,Fundamentals of Industrial Hygiene, National Safety Council,2012
5. David L. Goetsch, Occupational Safety and Health for Technologists, Engineers, and Managers, Pearson, 2018.

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

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B.Tech. III Year II Semester

Design of Automobile Transmission Systems
(Professional Elective-III)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0328Tc	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Explain the various elements involved in a transmission system.
- Focus on the various forces acting on the elements of a transmission system.
- Design the system based on the input and the output parameters.
- Produce working drawings of the system involving pulleys, gears, clutches and brakes.
- Demonstrate the energy considerations in the design of motion control elements.

	Syllabus	Total Hours:42
Unit-I	**Flexible power transmission systems & Design of bearing**	**8Hrs**

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**	**8Hrs**

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**	**9Hrs**

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**	**9Hrs**

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**	**8Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Design the suitable flexible power transmission elements and analyze the load conditions, and performance requirements.
- Analyze spur gear geometry and kinematics, and design spur gears for desired power transmission capacity based on bending and contact stress criteria.
- Design different types of gears by evaluating their efficiency, ensuring reliable performance in mechanical power transmission systems.
- Model kinematic and force characteristics of helical, bevel, and worm gearing for wind-turbine gearbox assemblies.

- Design various types of clutches and brakes, analyze and choose appropriate friction materials for effective motion control.

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

Reference Books:

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

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B.Tech. III Year II Semester

Mechanics and Manufacturing of Composite Materials
(Professional Elective-III)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0328Td	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Fundamentals of composite materials, including their classification, and to familiarize them with various fiber-reinforced plastic processing techniques used in manufacturing.
- Understanding of the micro- and macro-mechanical behavior of composite laminas.
- Equip theoretical and analytical tools for evaluating the strength and mechanical behavior of composite laminates
- Introduce metal matrix composites (MMCs), focusing on reinforcement materials, base metal selection, fabrication techniques.
- Deep understanding of micromechanics-based failure analysis in unidirectional composite laminas, and the selection of appropriate failure criteria.

Syllabus		Total Hours:36
Unit-I	**Introduction to Composite Materials & Fiber Reinforced Plastic Processing**	**8Hrs**

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 & Macro Mechanical Analysis of a Lamina**	**7Hrs**

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 & Macro Mechanical Analysis of Laminate**	**7Hrs**

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**	**7Hrs**

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	7Hrs

Micromechanics of Failure of Unidirectional Lamina, Anisotropic Strength and Failure Theories, Importance of Shear Strength, Choice of Failure Criteria, Examples.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Categorize different types of composite materials based on their characteristics and applications.
- Compare and contrast different fabricating processes for fiber reinforced plastics.
- Explain the rule of mixture for evaluating the elastic moduli of a lamina.
- Identify the number of elastic constants for different types of materials using Hooke's law.
- Investigate the applicability of different biaxial strength theories to composite materials.
- Examine the effect of reinforcement materials on the properties of metal matrix composites.

Text Books:

1. K.K. Chawla, Composite Materials, Springer-Verlag, New York, 2012.
2. Madhujit Mukhopadhyay, Mechanics of Composite Materials and Structures, Universities Press (India) Pvt. Ltd.,2004

Reference Books:

1. Frank L Matthews and R D Rawlings, Composite Materials: Engineering and Science, Taylor and Francis, 2006.
2. Sumit Sharma, Composite Materials: Mechanics, Manufacturing and Modeling, S Chand And Company Ltd,2022.
3. Krishan K. Chawla,Composite Materials: Science and Engineering, Springer-Verlag New York Inc.,2013.
4. Autar K. Kaw,Mechanics of Composite Materials, Second Edition,CRC Press,2005.

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

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B.Tech. III Year II Semester

Introduction to Hybrid and Electric Vehicles (Professional Elective-III)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0328Te	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Foundational and applied knowledge of electric vehicle systems, battery technologies, and battery management systems.
- Understanding of electric vehicle power plants, and drive control techniques essential for efficient electric vehicle propulsion.
- Knowledge of hybrid and electric vehicle technologies, including their historical evolution and energy efficiency optimization.
- 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.
- Demonstration of hybrid and electric vehicle design, energy management strategies for efficient and sustainable vehicle operation

Syllabus		**Total Hours:36**
Unit-I	**Electric Vehicle Propulsion and Energy Sources**	**8Hrs**
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**	**7Hrs**
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**	**7Hrs**
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**	**7Hrs**
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**	**7Hrs**
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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Solve problems involving the calculation of tractive power and energy required for electric vehicles, considering vehicle kinetics and dynamics.
- Classify different types of traction batteries (e.g., nickel metal hydride, Li-Ion, Li-polymer) based on their specific energy, specific power, and Ragone plot characteristics.
- Use simulation tools to operate and analyze the performance of a buck-boost DC/DC converter in an electric vehicle power system.
- Illustrate the power flow and energy efficiency in a parallel hybrid electric vehicle drive train topology.
- Examine the design and performance of the Toyota Prius hybrid vehicle, identifying key features that contribute to its fuel efficiency and emissions reduction.
- Complete the development of an energy management strategy for a hybrid electric vehicle, considering classification, comparison, and implementation aspects.

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.

Reference Books:

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

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B.Tech. III Year II Semester

Heat Transfer Lab					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0329P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- Understand different modes of heat transfer
- Gain knowledge about natural and force convection phenomenon
- Estimate experimental uncertainty in measurements

List of Experiments	**Total Hours:36**

List of Experiments: Conduct any 10 experiments from the following list of experiments.

Module I: Conduction

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. Experiment on un study state heat transfer

Module II: Convection

1. Determine the efficiency of a pin fin in natural and forced convection.
2. Determine the heat transfer coefficient for a vertical cylinder in natural convection
3. Determine the heat transfer coefficient in forced convection of air in a horizontal tube.
4. Determine the heat transfer coefficients on film and drop wise condensation apparatus.
5. Study the pool boiling phenomenon and different regimes of pool boiling.
6. Experiment on pool boiling

Module III: Radiation

1. Determine the emissivity of the test plate surface.
2. Experiment on Stefan-Boltzmann apparatus

Module IV: Application

1. Determine the effectiveness of a parallel and counter flow heat exchanger.
2. Determine the heat transfer rate coefficient in fluidized bed apparatus.
3. Study of conventional heat pipe.

Virtual Lab:-

1. Determination of thermal conductivity of a metal rod
https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/determination-of-thermalconductivity-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 https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=351&cnt=1
Course Outcomes(CO):
Upon completion of this course, students should be able to: • Explain different modes of heat transfer • Identify parameters for measurement for calculating heat transfer • Determine effectiveness of heat exchanger • Design new equipment related to heat transfer • Apply principles of heat transfer in wide application in industries.

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B.Tech. III Year II Semester

CAD/CAM Lab					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0330P	**0:0:3**	**1.5**	**CIE:30 SEE:70**	**3 Hours**	**PC**

Course Objectives:

- Develop students‘ skills in drafting and understanding orthographic, isometric views, and CAD file formats like DXE and IGES.
- Enable the creation of 3D part models using basic and advanced features in CAD tools.
- Hands-on experience in assembly modeling using both feature-based and Boolean-based methods.
- Familiarize with CAM software for generating NC code for various machining processes.
- Expertise industrial manufacturing via the use of post-processors and NC machines for real-time machining

List of Experiments	**Total Hours:36**

List of Experiments:

CAD:

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

CAM:

1. Study of various post processors used in NC Machines.
2. Development of NC code for free form and sculptured surfaces using CAM packages.
3. 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,.
4. Evaluation of Stress/Strain for a plate with a hole.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Use CAD tools to create orthographic and isometric drawings of mechanical components, ensuring accurate representation of dimensions and tolerances.
- Use CAD software to create 3D models of mechanical components using techniques such as protrusion, revolve, and shell sweep.
- Use CAD software to assemble 3D models of simple mechanical components.
- Use CAM software and appropriate post processors to generate NC code for free form and sculptured surfaces.
- Use NC machines to machine simple components by transferring NC code from CAM software.
- Use computational tools to determine stress and strain in a plate with a hole.

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B.Tech. III Year II Semester

3D Printing Lab (Skill Oriented Course-IV)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0331	**0: 1: 2**	**2**	**CIE:30 SEE:70**	**3 Hours**	**SEC**

Course Objectives:

- Understand different methods of 3D Printing.
- Gain knowledge about simulation of FDM process
- Estimate time and material required for manufacturing a 3D component

List of Experiments	**Total Hours:36**

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 and find strength of 3D Printed part using UTM machine.
Exp 2 : 3D Printing of modelled component by varying orientation and find strength of 3D Printed part using UTM machine..
Exp 3: 3D Printing of modelled component by varying infill and find strength of 3D Printed part using UTM machine.

Module 3:

Study on effect of different materials like ABS, PLA, TPU, PETG 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

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Explain different types of 3d Printing techniques.
- Identify parameters for powder binding and jetting process.
- Determine effective use of ABS material for 3D Printing.
- Apply principles of mathematics to evaluate the volume of material require.

Reference Books:

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:

- 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

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B.Tech. III Year II Semester

Technical Writing Skills & IPR					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0053T	**2: 0: 0**	**0**	**CIE:30**	**3 Hours**	**MC**

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

- To enable the students to practice the basic skills of research paper writing
- To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
- To practice the basic skills of performing quality literature review
- To help them in knowing the significance of real life practice and procedure of Patents.
- To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

Syllabus		Total Hours:24
Unit – I	**Principles of Technical Writing**	**5 Hrs**

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings discussing your limitations -hedging and criticizing -plagiarism and paraphrasing.

Unit – II	**Technical Research Paper Writing**	**5 Hrs**

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature-Problems and Framing Research Questions- Synopsis

Unit – III	**Process of research**	**5 Hrs**

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	**Introduction to Intellectual property & Trade Marks**	**5 Hrs**

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

Unit - V	**Law of copy rights & patents**	**4 Hrs**

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Identify key secondary literature related to their proposed technical paper writing
- Explain various principles and styles in technical writing
- Use the acquired knowledge in writing a research/technical paper.
- Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.
- Evaluate different forms of IPR available at national & international level
- Develop skill of making search of various forms of IPR by using modern tools and techniques.

Text Books:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. Technical Communication:Principles and practices.Oxford.

Reference 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 PapersSecond Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, Technical Writing Style

Online Learning Resources:

- https://theconceptwriters.com.pk/principles-of-technical-writing/
- https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
- https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
- https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paperjournal/
- https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
- https://lawbhoomi.com/intellectual-property-rights-notes/
- https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

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B.Tech. III Year II Semester

Disaster Management
Open Electives-II

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0150T	3: 0: 0	3	CIE:30 SEE:70	3 Hours	OE

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

- To understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
- To Analyse the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
- To apply wind engineering principles and computational techniques in designing wind-resistant structures.
- To evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
- To assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Syllabus		Total Hours:42
Unit – I	**Introduction to Natural Disasters**	**9 Hrs**
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**	**9Hrs**
Climate Change and Its Impact On Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structures in 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**	**8 Hrs**
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**	**8 Hrs**
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**	**8 Hrs**
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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
- Analyse the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
- Apply wind engineering principles and computational techniques in designing wind-resistant structures.
- Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
- Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Text Books:

1. David Alexander, Natural Disasters, 1st Edition, CRC Press, 2017.
2. Edward A. Keller and Duane E. De Vecchio, Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes, 5th Edition, Routledge, 2019.

Reference Books:

1. Ben Wisner, J.C. Gaillard, and Ilan Kelman (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. Bimal Kanti 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

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B.Tech. III Year II Semester

Sustainability in Engineering Practices
Open Electives-II

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0151T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OE**

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

- To understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
- To Analyse sustainable construction materials, their durability, and life cycle assessment.
- To apply energy calculations in construction materials and assess their embodied energy.
- To evaluate green building standards, energy codes, and performance ratings.
- To assess the environmental effects of energy use, climate change, and global warming.

Syllabus		Total Hours:42
Unit – I	**Introduction**	**9 Hrs**
Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO_2 Contribution From Cement and Other Construction Materials.		
Unit – II	**Materials Used in Sustainable Construction**	**9Hrs**
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**	**8 Hrs**
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**	**8 Hrs**
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**	**8 Hrs**
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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
- Analyse sustainable construction materials, their durability, and life cycle assessment.
- Apply energy calculations in construction materials and assess their embodied energy.
- Evaluate green building standards, energy codes, and performance ratings.
- Assess the environmental effects of energy use, climate change, and global warming.

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.

Reference Books:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in 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/

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B.Tech. III Year II Semester

Renewable Energy Sources Open Electives-II					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0232T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- To understand solar radiation principles, measurement techniques, and geometric relationships for solar energy applications.
- To analyze flat plate and concentrating solar collectors for thermal energy conversion and storage systems.
- To comprehend photovoltaic effect principles in crystalline silicon and various PV technologies.
- To design and analyze stand-alone and grid-connected photovoltaic systems with proper electrical characteristics.
- To understand wind energy conversion principles and aerodynamic forces acting on wind turbine blades.
- To evaluate wind data, site selection criteria, and design considerations for horizontal and vertical axis wind machines.
- To estimate geothermal energy resources and understand various geothermal sources including hydrothermal and hot dry rock systems.
- To assess advantages, limitations, and applications of geothermal energy with focus on Indian prospects.
- To analyze ocean energy systems including tidal and wave energy conversion principles and their operational methods.
- To understand biomass conversion technologies, biogas generation, and fuel cell principles with their performance characteristics and applications.

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Solar Energy**	**10Hrs**

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**	**9Hrs**

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**	**10Hrs**

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**	**10Hrs**

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	9Hrs
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.		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand principle operation of various renewable energy sources.
- Identify site selection of various renewable energy sources.
- Analyze various factors affecting on solar energy measurements, wind energy conversion techniques, Geothermal, Biomasss, Tidal Wave and Fuel cell energies
- Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems.
- Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

Textbooks:

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

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B.Tech. III Year II Semester

Digital Electronics
Open Electives-II

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0443T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
- To analyze combinational circuits like adders, subtractors, and code converters.
- To explore combinational logic circuits and their applications in digital design.
- To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
- To gain knowledge about programmable logic devices and digital IC's.

Syllabus		Total Hours: 48Hrs
Unit-I	Solar Energy	10Hrs
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	PV Energy Systems	9Hrs
Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Binary Multipliers, Code converters- Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.		
Unit -III	Wind Energy	10Hrs
Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.		
Unit -IV	Geothermal Energy	10Hrs
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	Miscellaneous Energy Technologies	9Hrs
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).		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand the Boolean algebra, logic simplification techniques
- Implement the minimization techniques for combinational circuit design
- Analyze the combinational circuits like adders, subtractors, multipliers and code converters
- Explore the combinational logic circuits and their applications in digital design
- Understand the sequential logic circuits, including latches, flip-flops, counters, and shift registers
- Understand the programmable logic devices and digital IC's

Textbooks:

1. Digital Design, M. Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, Zvi Kohavi and Nirah K. 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.

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B.Tech. III Year II Semester

Fundamentals of Operating Systems
Open Electives-II

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0548T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- 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

Syllabus		Total Hours: 48Hrs
Unit-I	**Operating Systems Overview, System Structures**	**10Hrs**
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**	**9Hrs**
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**	**10Hrs**
Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, 132 B.Tech - CSE R23 Regulation Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.		
Unit -IV	**Deadlocks, File Systems**	**10Hrs**
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**	**9Hrs**
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.		

Course Outcomes(CO):
After the completion of the course students will able to:

- Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication.
- Under stand 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.
- Analyze the memory management and its allocation policies.
- Able to design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms,

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:

1. https://nptel.ac.in/courses/106/106/106106144/ http://peterindia.net/OperatingSystems.html

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B.Tech. III Year II Semester

Machine Learning Open Electives-II					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0529T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- 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

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Introduction to Machine Learning**	**10Hrs**
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**	**9Hrs**
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**	**10Hrs**
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**	**10Hrs**
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**	**9Hrs**
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		

Course Outcomes(CO):

After the completion of the course students will able to:

- Identify machine learning techniques suitable for a given problem.
- Solve real-world problems using various machine learning techniques.

- Apply Dimensionality reduction techniques for data preprocessing.
- Explain what is learning and why it is essential in the design of intelligent machines
- Evaluate Advanced learning models for language, vision, speech, decision making etc

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

Web Reference:

1. https://onlinecourses.nptel.ac.in/noc20_cs29/preview
2. https://nptel.ac.in/courses/106106139

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B.Tech. III Year II Semester

Optimization Techniques
Open Electives-II

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0030T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- 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

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Linear programming I**	**10Hrs**
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**	**9Hrs**
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**	**10Hrs**
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**	**10Hrs**
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**	**9Hrs**
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.		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.
- Interpret the transportation models' solutions and infer solutions to the real-world problems.
- Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.
- Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives

- Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives.

Textbooks:

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.

Reference Books:

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:

1. https://onlinecourses.nptel.ac.in/noc24_ee122/preview
2. https://archive.nptel.ac.in/courses/111/105/111105039/
3. https://onlinecourses.nptel.ac.in/noc21_ce60/preview

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B.Tech. III Year II Semester

Mathematical Foundation of Quantum Technologies
Open Electives-II

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0029T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- 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.

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Linear Algebra Foundation for Quantum Mechanics**	**10Hrs**
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 ($\|\psi\rangle$, $\langle\varphi\|$, $\langle\varphi\|\psi\rangle$), Change of basis (transformations, unitary matrices).		
Unit-II	**From Finite to Infinite Dimensions**	**9Hrs**
Function spaces (L^2 space, square-integrable functions), Inner products for functions ($\int\psi^*\varphi\, dx$), 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**	**10Hrs**
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**	**10Hrs**
Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).		
Unit -V	**Advanced Topics**	**9Hrs**
Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand vector spaces, inner products, and linear operators with applications to quantum systems.
- Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite

dimensional systems.

- Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.
- Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations.
- Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum theory.

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 Reference:

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

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B.Tech. III Year II Semester

Physics of Electronic Materials and Devices
Open Elective-II

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0035T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To make the students to understand the concept of crystal growth, defects in crystals and thin films.
- To provide insight into various semiconducting materials and their properties.
- To develop a strong foundation in semiconductor physics and device engineering.
- To elucidate excitonic and luminescent processes in solid-state materials.
- To understand the principles, technologies, and applications of modern display systems.

Syllabus		Total Hours: 48Hrs
Unit-I	**Fundamentals of Materials Science**	**10Hrs**
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**	**9Hrs**
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 electronhole 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**	**10Hrs**
Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.		
Unit -IV	**Excitons and Luminescence**	**10Hrs**
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**	**9Hrs**
LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand crystal growth and thin film preparation
- Summarize the basic concepts of semiconductors
- Illustrate the working of various semiconductor devices
- Analyze various luminescent phenomena and the devices based on these concepts
- Explain the working of different display devices

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: 1. https://nptel.ac.in/courses/113/106/113106062/ 2. https://onlinecourses.nptel.ac.in/noc20_ph24/preview

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B.Tech. III Year II Semester

Chemistry of Polymers and Applications
Open Elective-II

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0041T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- To understand the basic principles of polymers
- To understand natural polymers and their applications.
- To impart knowledge to the students about synthetic polymers, their preparation and importance.
- To enumerate the applications of hydogel polymers
- To enumerate applications of conducting and degradable polymers in engineering

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Polymers-Basics and Characterization**	**10Hrs**

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**	**9Hrs**

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**	**10Hrs**

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**	**10Hrs**

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**	**9Hrs**

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.

Course Outcomes(CO):

After the completion of the course students will able to:

- Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer

- Describe the physical and chemical properties of natural polymers and Modified cellulosics.
- Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
- Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,
- Explain classification and mechanism of conducting and degradable polymers.

Textbooks:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

Reference 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.

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B.Tech. III Year II Semester

Academic Writing and Public Speaking
Open Elective - II

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0045T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- 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

Syllabus		Total Hours: 48Hrs
Unit-I	**Introduction to Academic Writing**	**10Hrs**
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**	**9Hrs**
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**	**10Hrs**
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**	**10Hrs**
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**	**9Hrs**
Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics - Paralanguage - Signs		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand various elements of Academic Writing
- Identify sources and avoid plagiarism
- Demonstrate the knowledge in writing a Research paper
- Analyse different types of essays
- Assess the speeches of others and know the positive strengths of speakers
- Build confidence in giving an impactful presentation to the audience

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 LanguageRHUS Publishers, 2016

Reference Books:

1. Alice Savage, Masoud Shafiei Effective Academic Writing,2Ed.,2014 Oxford University Press.
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-ofdelivery/
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/

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
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NELLORE–524317 (A.P) INDIA

B.TECH. (Regular-Full time)
MECHANICAL ENGINEERING
COURSE STRUCTURE AND SYLLABUS
UNDER B Tech ME- RG 23 REGULATIONS

IV-YEAR I SEMESTER

DEPARTMENT OF MECHANICAL ENGINEERING

Vision

To evolve as a prospective learning center producing competent Mechanical Engineers to full fill the ever-changing needs of society and industry demands.

Mission

M1. To Impart comprehensive knowledge and experience in Mechanical Engineering domain through the effective implementation of Teaching-Learning methodologies

M2. To promote the culture of Interdisciplinary learning and facilitate Industrial training to resolve global Engineering issues

M3. To Impart training on modern drafting and analysis software sharpening computational capabilities and promoting higher studies

M4. To Initiate Industry-Institute Interface facilitating skill enhancement keeping pace with emerging industrial trends by Infusing ethical values

Program Educational Outcomes

PE01. Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PE02. Pursue successful professional career in industry, academia or research.

PE03. Engage in continuous learning to keep abreast with emerging technologies with the sense of professional ethics.

PE04. Contribute in multi-disciplinary teams through effective interpersonal skills

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1: Utilize the knowledge of materials and manufacturing principles to plan, design and monitor the production operations of an Industry.

PSO2: Employ the governing laws of thermodynamics, heat transfer and refrigeration & air-conditioning to design and develop thermo-fluid system.

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B.Tech. IV Year I Semester (Theory-6, Lab-2, SEC-1, MC-1)

S.No	category	Course Code	Course Name	L	T	P	Credits
1.	PC	23A0549T	AI & ML for Mechanical Engineering	3	0	0	3
2.	HM	----	**Management Course- II**	2	0	0	2
		23A0049T	1. Business Ethics and Corporate Governance				
		23A0050T	2. E-Business				
		23A0048T	3. Management Science				
3.	PE	23A0333T	**Professional Elective-IV**	3	0	0	3
		23A0333Ta	1. Mechanical Vibrations				
		23A0333Tb	2. Finite Element Methods				
		23A0333Tc	3. Refrigeration & Air Conditioning				
		23A0333Td	4. Mechatronics & MEMS				
		23A0333Te	5. Power Plant Engineering				
4.	PE	23A0334T	**Professional Elective-V**	3	0	0	3
		23A0334Ta	1. Non Conventional Energy Sources				
		23A0334Tb	2. Automation & Robotics				
		23A0334Tc	3. Non-Destructive Testing				
		23A0334Td	4. Total Quality Management				
		23A0334Te	5. Smart Manufacturing				
5.	OE	---	**Open Elective-III**	3	0	0	3
6.	OE	---	**Open Elective-IV**	3	0	0	3
8.	SEC	23A0336	**Skill Enhancement Course** Introduction to Drone Technology	0	1	2	2
9.	MC	23A0054T	**Audit Course** Gender Sensitization	2	0	0	0
10.	PR	23A0337	**Internship** Evaluation of Industry Internship	0	0	0	2
			Total	18	1	04	21

Category	Credits
Humanities & Social Sciences including Management (HM)	02
Professional Core (PC)	03
Professional Elective (PE)	06
Open Elective (OE)	06
Mandatory Courses (MC)	00
Skill Enhancement Course (SEC)	02
Internships & Project work (PR)	02
Total	21

Open Elective – III

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23A0152T	Building Materials and Services	CIVIL
2.	23A0121T	Environmental Impact Assessment	
3.	23A0241T	Smart Grid Technologies	EEE
4.	23A0416T	Microprocessors and Microcontrollers	ECE
5.	23A0512T	Data Base Management Systems	CSE & Allied
6.	23A0532Tb	Cyber Security	
7.	23A0031T	Wavelet transforms and its applications	Mathematics
8.	23A0036T	Smart Materials and Devices	Physics
9.	23A0037T	Introduction to Quantum Mechanics	
10.	23A0042T	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
11.	23A0046T	Employability Skills	Science and Humanities

Open Elective – IV

S.No.	Course Code	Course Name	Offered by the Dept.
1.	23A0153T	Geo-Spatial Technologies	CIVIL
2.	23A0154T	Solid Waste Management	
3.	23A0242T	Electric Vehicles	EEE
4.	23A0444T	Transducers and Sensors	ECE
5.	23A0520T	Computer Networks & Internet Protocols	CSE & Allied
6.	23A0450T	Internet of Things	
7.	23A3315a	Introduction to Quantum Computing	
8.	23A0032T	Financial Mathematics	Mathematics
9.	23A0038T	Sensors and Actuators for Engineering Applications	Physics
10.	23A0043T	Chemistry Of Nanomaterials and Applications	Chemistry
11.	23A0047T	Literary Vibes	Science and Humanities

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B.Tech. IV Year II Semester

Semester–VIII							
S.No	category	Course Code	Course Name	L	T	P	Credits
1.	PR	23A0338	Internship	-	-	-	4
	PR	23A0339	Project	-	-	-	8
			Total	0	0	0	12

Category	**Credits**
Internship and Project Work (PR)	12
Total	12

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B.Tech. IV Year I Semester

AI & ML for Mechanical Engineering

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0549T	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**

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

- Knowledge of Artificial Intelligence, focusing on intelligent agents, problem-solving techniques, and state-space search approaches.
- Understand and apply various problem-solving and search techniques, including uniform and heuristic search strategies in artificial intelligence.
- Explore and apply local search techniques for solving Constraint Satisfaction Problems (CSPs) and adversarial search strategies to make optimal decisions.
- Apply various statistical reasoning techniques for knowledge representation and reasoning in AI, as well as logic programming and reasoning methods.
- Familiar in fundamental concepts of Machine Learning techniques, as well as classification, regression, clustering problems, and an introduction to neural networks and deep learning.

Syllabus		Total Hours:42
Unit – I	**Introduction to Artificial Intelligence and Problem-Solving Agent**	**9 Hrs**
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**	**9Hrs**
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**	**8Hrs**
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:**	**8 Hrs**
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**	**8 Hrs**
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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Illustrate the structure and behavior of intelligent agents in diverse environments.
- Use uniform search strategies to solve state space search problems.
- Classify heuristic search strategies based on their effectiveness in optimization tasks.
- Solve constraint satisfaction problems using local search algorithms.
- Examine the role of Bayesian networks in reasoning under uncertainty.
- Complete a classification task using supervised machine learning techniques.

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

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B.Tech. IV Year I Semester

Business Ethics and Corporate Governance
Management Course- II

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0049T	3: 0: 0	3	CIE:30 SEE:70	3 Hours	HM

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

- To make the student understand the principles of business ethics
- To enable them in knowing about the ethics in management
- To facilitate the student‘ role in corporate culture
- To impart knowledge about the fair-trade practices
- To encourage the student in knowing about the corporate governance

Syllabus		Total Hours:42
Unit – I	**Ethics**	**9 Hrs**

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.

Unit – II	**Ethics in Management**	**9Hrs**

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.

Unit – III	**Corporate Culture**	**8Hrs**

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.

Unit - IV	**Legal Frame Work**	**8 Hrs**

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.

Unit - V	**Corporate Governance**	**8 Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand the Ethics and different types of Ethics. L2
- Understand business ethics and ethical practices in management L2
- Understand the role of ethics in management L2
- Apply the knowledge of professional ethics & technical ethics L3
- Analyze corporate law, ethics, codes & principles L4
- Evaluate corporate governance & corporate scams

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

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc21_mg46/
- https://archive.nptel.ac.in/courses/110/105/110105138/
- https://onlinecourses.nptel.ac.in/noc21_mg54/
- https://onlinecourses.nptel.ac.in/noc22_mg54/
- https://archive.nptel.ac.in/courses/109/106/109106117/

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B.Tech. IV Year I Semester

E-Business
Management Course- II

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0050T	3: 0: 0	3	CIE:30 SEE:70	3 Hours	HM

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

- To provide knowledge on emerging concept on E-Business related aspect.
- To understand various electronic markets & business models.
- To impart the information about electronic payment systems & banking.
- To create awareness on security risks and challenges in E-commerce.
- To the students aware on different e-marketing channels & strategies

Syllabus		Total Hours:42
Unit – I	**Electronic Business**	**9 Hrs**

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce – E-Commerce and EBusiness, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Unit – II	**Electronic Markets and Business Models**	**9Hrs**

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

Unit – III	**Electronic Payment Systems**	**8Hrs**

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, ewallets, 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 epayments

Unit - IV	**E-Security**	**8 Hrs**

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.

Unit - V	**E-Marketing**	**8 Hrs**

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)

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Remember E-Business & its nature, scope and functions.
- Understand E-market-Models which are practicing by the organizations
- Apply the concepts of E-Commerce in the present globalized world.
- Analyze the various E-payment systems & importance of net banking.
- Evaluate market research strategies & E-advertisements.
- Understand importance of E-security & control

Text Books:

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

Reference Books:

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.

Online Learning 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

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B.Tech. IV Year I Semester

Management Science
Management Course- II

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0048T	3: 0: 0	3	CIE:30 SEE:70	3 Hours	HM

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

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in modern management

Syllabus		Total Hours:42
Unit – I	**Introduction to Management**	**9 Hrs**

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.

Unit – II	**Operations Management**	**9Hrs**

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.

Unit – III	**Human Resources Management (HRM)**	**8Hrs**

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

Unit - IV	**Strategic & Project Management**	**8 Hrs**

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).

Unit - V	**Contemporary Issues in Management**	**8 Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Remember the concepts & principles of management and designs of organization in a practical world
- Understand the knowledge of Work-study principles & Quality Control techniques in industry
- Apply the process of Recruitment & Selection in organization.
- Analyze the concepts of HRM & different training methods.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create awareness on contemporary issues in modern management & technology.

Text Books:

1. Frederick S. Hillier, Mark S. Hillier. Introduction to Management Science, October 26, 2023
2. A.R Aryasri, Management Science, TMH, 2019

Reference Books:

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

Online Learning Resources:

- https://www.slideshare.net/slideshow/introduction-to-management-and-organization-231308043/231308043
- https://nptel.ac.in/courses/112107238
- https://archive.nptel.ac.in/courses/110/104/110104068/
- https://archive.nptel.ac.in/courses/110/105/110105069/
- https://onlinecourses.nptel.ac.in/noc24_mg112/

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B.Tech. IV Year I Semester

Mechanical Vibrations
(Professional Elective-IV

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0333Ta	3: 0: 0	3	CIE:30 SEE:70	3 Hours	PE

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

- Introduce fundamental concepts of vibration analysis, focusing on Single Degree Freedom (SDOF) systems and their solutions.
- Develop understanding of forced vibration, resonance, and damping effects in Single Degree Freedom systems, including vibration isolation.
- Explore the dynamics of Two Degree Freedom (2DOF) systems and their application in vibration absorbers and coupled systems.
- Familiarize Multi Degree Freedom (MDOF) systems, methods for formulating equations of motion, and vibration analysis techniques.
- Explain vibration measurement tools, transducers, and exciters used in experimental vibration analysis.

Syllabus		Total Hours:42
Unit – I	**Single Degree Freedom Systems & Whirling of shafts**	**9 Hrs**

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**	**9Hrs**

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**	**8 Hrs**

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**	**8 Hrs**

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**	**8 Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Construct equivalent single-degree-of-freedom models to predict free and damped vibration responses in power-generation turbine shaft systems.
- Identify critical speeds of shafts using Dunkerley's lower-bound approximation to ensure safe operation of high-speed compressor rotors in petrochemical plants.
- Solve steady-state forced vibration problems to design effective isolation systems and optimize transmissibility in heavy-machinery foundations within the mining industry.
- Develop dynamic vibration absorbers to attenuate resonance phenomena in automotive engine-mount assemblies.
- Experiment with Lagrangian formulation and Holzer's method to analyze natural frequencies and mode shapes of multi-degree-of-freedom structures in aerospace wing assemblies.
- Utilize piezoelectric and LVDT transducers to measure vibration signatures for predictive maintenance of CNC manufacturing lines.

Text Books:

1. Singiresu S. Rao, Mechanical Vibrations, Pearson Education, 6/e, 2018.
2. G.K.Groover, Mechanical Vibrations, Nemchand& Bro, 8/e, 2009
3. RV Chalam, Mechanical Vibrations, 1st Edition PHI, 2014.

Reference Books:

1. Rao V. Dukkipati and J. Srinivas, Mechanical Vibrations, PHI Learning (India),2012
2. S. Graham Kelly, Mechanical Vibrations: Theory and Applications, SI Edition,CL Engineering,2011
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

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B.Tech. IV Year I Semester

Finite Element Methods (Professional Elective-IV)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0333Tb	**3: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- Learn basic principles of finite element analysis procedure.
- Gain knowledge of the concepts of Nodes and elements.
- Know the theory and characteristics of finite elements that represent engineering structures.
- Apply finite element solutions to structural, thermal, and dynamic problems.
- Develop the knowledge and skills to evaluate finite element analyses and apply design analysis Effectively.

Syllabus		**Total Hours:42**
Unit – I	**Introduction to finite element methods & One-dimensional Problems**	**9 Hrs**

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**	**8Hrs**

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**	**8 Hrs**

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**	**8 Hrs**

Quadrilateral Elements: Isoparametric, Sub parametric and Super parametric elements, Modelling of 4 noded quadrilateral elements and simple problems. Numerical Integration.

Steady state heat transfer analysis: One dimensional analysis of composite slab and fin.

Unit - V	**Dynamic analysis**	**9 Hrs**

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

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand the concepts behind formulation methods in FEA
- Explain the concepts of Nodes and elements used in the analysis of beams and solve the simple problems
- Understand the 2D stress analyses of the FEM method and solve the strain triangles.
- Apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
- Identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer and fluid flow.

Text Books:

1. T. Chandraputla, Ashok Belegundu, Introduction to Finite Element in Engineering, Pearson Publications, 4/e, 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, 2020.

Reference Books:

1. S. S. Bhavikatti, Finite Element Analysis, New Age International Private Limited,2021
2. P. Seshu,Textbook of Finite Element Analysis,PHI Learning Pvt. Ltd.,2012.
3. G.Lakshmi Narasaiah, 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/

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B.Tech. IV Year I Semester

Refrigeration & Air Conditioning (Professional Elective-IV)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0333Tc	**3:0:0**	**3**	**CIE: 30 SEE:70**	**3 Hours**	**PE**

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

- Present the fundamental concepts and laws of refrigeration systems including Carnot and air-based cycles.
- Explain the working principles, components, and performance parameters of vapour compression refrigeration systems.
- Knowledge of alternative refrigeration systems such as vapour absorption, steam jet, thermoelectric, and vortex refrigeration.
- Understanding of psychrometric processes and air conditioning load calculations.
- Familiarize with air conditioning components and the concept of human thermal comfort and heat pumps

NOTE: Tables/Codes: Thermal Engineering Data Book containing refrigerant and Psychrometric property Tables and charts are permitted in Exam

Syllabus		**Total Hours:42**
Unit- I	**Introduction to Refrigeration & Air Refrigeration**	**8Hrs**

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**	**9Hrs**

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 & Steam Jet Refrigeration System**	**9Hrs**

VAR:Vapor Absorption Refrigeration (VAR) System-Description and Working of NH3 - Water System and lithium bromide -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**	**8Hrs**

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	8Hrs
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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Construct T-S and P-h diagram representations of vapor compression refrigeration cycles for industrial cold-storage plants.
- Solve refrigeration load and COP calculations for aircraft air-refrigeration systems in aerospace environmental control applications.
- Develop performance evaluation models for vapor absorption refrigeration systems in district cooling and large-scale HVAC installations.
- Model steam-jet refrigeration and vortex-tube operation for process-cooling units in the chemical and petrochemical industries.
- Utilize psychrometric charts and processes to size and select HVAC equipment for commercial building climate-control systems.
- Select and size air-handling units, humidifiers, and dehumidifiers for data-center cooling and clean-room applications.

Text Books:

1. C P Arora, Refrigeration and Air Conditioning, TMH, 15/e, 2013.
2. S. C Arora & Domkundwar, A Course in Refrigeration and Air conditioning, Dhanpat rai & Co, 2018

Reference Books:

1. Manohar Prasad , Refrigeration and Air Conditioning, New Age, 2/e, 2013
2. Dossat, Principles of Refrigeration, Pearson Education, 4/e, 2007
3. P.L.Ballaney, Refrigeration and Air Conditioning, 2/e, 2012.
4. P.N.Ananthanarayanan, Basic Refrigeration and Air-Conditioning, TMH, 4/e, 2013

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-dynamicslaboratory/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

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B.Tech. IV Year I Semester

Mechatronics and MEMS
(Professional Elective-IV)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0333Td	3:0:0	3	CIE:30 SEE:70	3 Hours	PE

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

- To introduce the concept of mechatronics and its significance in modern industrial applications.
- To explain the working principles, characteristics, and selection of various types of sensors.
- To describe different actuator systems and their integration in automation circuits.
- To develop understanding of microprocessors, microcontrollers, and PLCs including programming and control logic.
- To explore MEMS technologies, fabrication techniques, and their applications in miniaturized systems.

Syllabus		Total Hours:42
Unit-I	**Introduction**	**9Hrs**

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**	**8Hrs**

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**	**8Hrs**

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**	**8Hrs**

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)**	**9Hrs**

History, Effect of scaling, Fabrication Techniques: Oxidation, Physical Vapor disposition, Chemical Vapor Deposition, Lithography, Etching, Wafer bonding, LIGA, DRIE, Applications: Lab on chip.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Demonstrate the mechatronics design process to integrate CNC machines and industrial robots in flexible manufacturing systems.
- Employ sensor selection criteria to configure force, pressure, and temperature sensors within tool-monitoring and automatic inspection systems.
- Operate hydraulic and pneumatic actuation circuits for robotic manipulators in automated packaging lines.
- Implement PLC ladder-logic routines (sequencing, timers, counters, analog I/O) for control of assembly-line and inspection processes.
- Execute microcontroller-based control algorithms for real-time tool monitoring and adaptive CNC machining operations.
- Illustrate MEMS fabrication steps to prototype lab-on-chip sensors for biomedical and environmental applications.

Text Books:

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

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B.Tech. IV Year I Semester

Power Plant Engineering
(Professional Elective-IV)

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
23A0333Te	3:0:0	3	CIE:30 SEE:70	3Hours	PE

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

- Familiarize the sources of energy, power plant economics and environmental aspects.
- Outline the working components of different power plant.
- Understand the working mechanism of diesel and gas turbine power plants.
- Impart types of nuclear power plants, and outline working principle and advantages and hazards.
- Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.

Syllabus — **TotalHours:42**

Unit–I	Introduction to the Sources of Energy	9 Hrs

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 ang Combustion Process	9 Hrs

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.CO_2 Recorders.

Unit–III	Diesel Power Plant & Gas Turbine Plant	8 Hrs

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 & Hydro Projects Plant	8 Hrs

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, Nuclear Power Station, Types of Reactors	8 Hrs

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

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

- Demonstrate power-plant economic assessment techniques for optimizing capital and operating costs in the thermal power generation industry.
- Employ combustion-system design principles to configure pulverized-fuel burners and flue-gas control in steam-power plants.
- Implement layout and auxiliary-system configurations for combined-cycle gas-turbine plants to enhance efficiency and reduce emissions in the gas-turbine power sector.
- Construct hydrograph and storage-dam models for planning and designing hydroelectric power projects in the hydropower industry.
- Operate and calibrate solar-collector and wind-turbine systems for on-site power generation in non-conventional energy facilities.
- Execute radiation-shielding and waste-disposal protocols for safety compliance in nuclear reactor operations within the nuclear power industry.

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

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B.Tech. IV Year I Semester

Non Conventional Energy Sources (Professional Elective-V)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0334Ta	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- To introduce the principles of solar radiation and its measurement for energy applications.
- To explain the types and working principles of solar energy collectors and storage systems.
- To provide an understanding of various renewable energy sources including wind, biomass, and geothermal energy.
- To explore ocean energy technologies and direct energy conversion systems like thermoelectric generators and fuel cells.
- To assess the economic and environmental impacts of renewable energy systems and their integration into energy infrastructure.

Syllabus		**Total Hours:36**
Unit-I	**Principles Of Solar Radiation**	**9Hrs**

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**	**8Hrs**

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 & Wind Energy**	**8Hrs**

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 & Geothermal Energy**	**8Hrs**

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 & Direct Energy Conversion**	**9Hrs**

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

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Demonstrate solar radiation modeling techniques for photovoltaic system design in utility-scale solar power plants.
- Employ thermal analysis methods to optimize flat-plate and concentrating collector performance in industrial process heating applications.
- Construct latent-heat and stratified thermal storage system designs for commercial solar heating and cooling facilities.
- Operate performance-analysis protocols for horizontal-axis and vertical-axis wind turbines in utility wind farm operations.
- Implement anaerobic digestion and gas-cleaning processes for bio-gas production and utilization in cogeneration plants.
- Execute thermodynamic cycle simulations for ocean thermal energy conversion and MHD generator systems in marine power pilot projects.

Text Books:

1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publisher, 2014.
2. Anjaneyulu Yerramilli, Francis Tuluri, Energy Resources Utilization and Technologies, BS Publications, 2012.

Reference Books:

1. Twidell & Weir, Renewable Energy Sources/ 3rd edition Routledge publisher , 2015)
2. B.H.Khan, Non Conventional Energy Resources, McGrawHIll, 2015
3. D. Yogi Goswami, Frank Krieth & John F Kreider, Principles of Solar Energy, CRC Press,2000.
4. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd,2022.

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

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B.Tech. IV Year I Semester

Automation & Robotics (Professional Elective-V)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0334Tb	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- To introduce the fundamentals of industrial automation, its types, components, and strategies across manufacturing systems.
- To explain the working of automated flow lines and the methods used in assembly line balancing and flexible automation.
- To impart knowledge about industrial robots, their configurations, anatomy, and applications in manufacturing processes.
- To develop an understanding of manipulator kinematics, homogeneous transformations, actuators, and sensors used in robotics.
- To analyze manipulator dynamics and apply trajectory planning techniques for robotic motion and obstacle avoidance.

Syllabus		**Total Hours:42**
Unit-I	**Fundamentals of Automation**	**8Hrs**

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**	**9Hrs**

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**	**9Hrs**

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**	**8Hrs**

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 Application in Manufacturing	8Hrs

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Implement mechanical feeder and orienter integration for automotive manufacturing automation.
- Execute quantitative flow line analysis to optimize electronics assembly plant throughput.
- Employ D-H kinematic modeling for welding robot motion planning in automotive production cells.
- Utilize dynamic modeling techniques to assess painting robot performance in aerospace coating processes.
- Perform trajectory planning for collision-free material handling in warehouse robotics systems.
- Develop robot programming strategies for spot welding and spray painting in automotive assembly lines.

Text Books:

1. M.P. Groover, Automation , Production systems and CIM, 4thEdition, Pearson education (2016)
2. M.P. Groover, Industrial Robotics: Technology, Programming, and Applications, 2nd Edition (Special Indian Edition), McGraw Hill Education, 2017

Reference Books:

1. Fu K S, Robotics , McGraw Hill, 4th edition, 2010.
2. Ashitave Ghosal, Robotics, Fundamental Concepts and analysis, Oxford Press, 1/e, 2006
3. Mittal R K &Nagrath I J , Robotics and Control , TMH, 2003.

Online Learning Resources:

- 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-roboticsVideoreferences
- http://nptel.iitm.ac.in/video.php?courseId=1052

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B.Tech. IV Year I Semester

Non-Destructive Testing (NDT) (Professional Elective-V)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0334Tc	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- To introduce the principles, types, and safety aspects of various non-destructive testing (NDT) techniques including radiographic and ultrasonic methods.
- To explain the theory, equipment, and evaluation procedures for ultrasonic, liquid penetrant, eddy current, and magnetic particle tests.
- To familiarize students with advanced thermal and infrared inspection techniques and their applications.
- To examine the use of specialized materials, sensors, and methods in thermal and IR-based NDT techniques.
- To explore the wide-ranging industrial applications of NDT in fields such as aerospace, automotive, railways, and pressure vessel inspection

Syllabus		**Total Hours:42**
Unit-I	**Introduction to non-destructive testing**	**8Hrs**

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**	**9Hrs**

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**	**8Hrs**

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**	**9Hrs**

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	8Hrs

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Implement radiographic testing for weld integrity evaluation in nuclear power plant pressure vessels.
- Demonstrate ultrasonic flaw detection techniques for corrosion mapping in offshore oil & gas pipelines.
- Employ liquid penetrant and magnetic particle inspections to identify surface cracks in aerospace-grade aluminum parts.
- Execute eddy current evaluation of heat exchanger tubing in thermal power stations.
- Operate infrared thermography systems for defect characterization in composite sandwich structures within aviation manufacturing.
- Illustrate the selection and integration of appropriate NDE methods for quality assurance in automotive assembly lines.

Text Books:

1. J Prasad, GCK Nair ,Non destructive test and evaluation of Materials, Tata mcgrawHill Education Publishers, 2008.
2. Baldev Raj, M. Thavasimuthu, T. Jayakumar, Practical Non-Destructive Testing, Narosa Publishing House ,2011

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
3. Lari & Kumar, Basics of Non-Destructive Testing, S.K. Kataria & Sons, 2013.

Online Learning Resources:

- http://www.twivirtualacademy.com/online-courses/ndt/
- https://www.classcentral.com/course/swayam-theory-and-practice-of-non-destructivetesting-9872
- https://onlinecourses.nptel.ac.in/noc20_mm07/preview
- https://www.youtube.com/watch?v=dyMR58TZMbo
- https://www.youtube.com/watch?v=Wam-Ewcn3aQ
- https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_NDT_LECTURE_NOTES.pdf
- https://lecturenotes.in/subject/390/non-destructive-testing

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B.Tech. IV Year I Semester

Total Quality Management (Professional Elective-V)					
Course Code	**L:T:P**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0334Td	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PE**

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

- To introduce the fundamental concepts, definitions, and dimensions of quality and Total Quality Management (TQM).
- To explore the evolution of quality management through historical perspectives and contributions of quality gurus.
- To explain the core principles of TQM including customer satisfaction, employee involvement, and continuous improvement.
- To analyze the various TQM tools such as Benchmarking, QFD, FMEA, Six Sigma, and their role in quality enhancement.
- To provide an understanding of quality systems like ISO 9000, ISO 14000, QS 9000, and the processes for their implementation.

Syllabus		Total Hours:36
Unit-I	**Introduction to TQM**	**8Hrs**

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**	**8Hrs**

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**	**9Hrs**

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**	**9Hrs**

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**	**8Hrs**

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.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Construct cost-of-quality analysis models to optimize defect reduction in automotive manufacturing assembly lines.
- Develop PDSA-based quality improvement plans to enhance process efficiency in pharmaceutical production facilities.
- Utilize benchmarking methods to evaluate supplier performance in the electronics supply chain industry.
- Select and implement ISO 9001 documentation protocols for standardized quality management in aerospace component fabrication.
- Experiment with Taguchi quality loss function modeling to boost design robustness of automotive suspension systems.
- Solve FMEA-based risk assessment scenarios to prioritize maintenance actions in power generation plants.

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, 2022.
2. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015

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/

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B.Tech. IV Year I Semester

Smart Manufacturing
(Professional Elective-V)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0334Te	3:0:0	3	CIE:30 SEE:70	3 Hours	PE

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

- Understand the fundamental concepts of Smart Manufacturing, Industry 4.0 and IoT in Manufacturing
- Understand the fundamental concepts of Data Analytics and Artificial Intelligence in Manufacturing
- Know about Smart Sensors, RFID, and Block chain in Manufacturing
- Explain the techniques of Digital Twin & Simulation in Manufacturing
- Familiarize Sustainable and Green Manufacturing

Syllabus		Total Hours:36
Unit-I	**Introduction to Smart Manufacturing & Cyber-Physical Systems & Industrial IoT**	**8Hrs**

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, Artificial Intelligence, Automation & Robotics in Manufacturing**	**7Hrs**

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, Edge Computing, Smart Sensors, RFID, and Block chain in Manufacturing**	**7Hrs**

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 System

Unit-IV	**Digital Twin & Simulation in Manufacturing and Cybersecurity in Smart Manufacturing**	**7Hrs**

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 & Case Studies and Future Trends**	**7Hrs**
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		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Construct Industry 4.0 implementation roadmaps for legacy production systems in automotive manufacturing.
- Develop MQTT- and OPC-UA–enabled IIoT architectures for real-time machine health monitoring in steel plants.
- Utilize deep learning–based predictive maintenance algorithms for anomaly detection in petrochemical processing.
- Model collaborative robot assembly workflows to optimize throughput in aerospace component manufacturing.
- Plan cloud-edge computing solutions for scalable Manufacturing Execution Systems in pharmaceutical production.
- Experiment with digital twin simulations to evaluate cyber-physical vulnerabilities in semiconductor fabrication facilities.

Text Books:

1. J. Paulo Davim , Green Manufacturing Processes and Systems, Springer 2013
2. Kamalakar Mutalik, Smart manufacturing, The Righte order, 2023.

Reference Books:

1. Dr. Rajkumar. E, Introduction To Smart Manufacturing and Automation, Namya Press, 2024, Delhi.
2. Michael Deng, Smart Manufacturing, Colin Koh Kindle Edition, 2023.

Online Learning Resources:

- https://www.youtube.com/watch?v=sdgI072DJNM&pp=ygUUU01BUlQgTUFOVUZBQ1RVUklORyA%3D(2023)

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B.Tech. IV Year I Semester

Introduction to Drone Technologies
(Skill Enhancement Course)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0336	3:0:0	3	CIE:30 SEE:70	3 Hours	SEC

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

- To learn and understand the fundaments of design, fabrication and programming of drone
- To teach technical characteristics of the Drone parts and its functions
- To impart the knowledge of an flying and operation of drone
- To know about the various applications of drone
- To understand the safety risks and guidelines of fly safely

Syllabus		Total Hours:42
Unit-I	**Introduction to Drone Technology**	**8Hrs**
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**	**9Hrs**
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**	**9Hrs**
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**	**8Hrs**
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**	**8Hrs**
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		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Construct cost-of-quality analysis models to optimize defect reduction in automotive manufacturing assembly lines.
- Develop PDSA-based quality improvement plans to enhance process efficiency in pharmaceutical production facilities.
- Utilize benchmarking methods to evaluate supplier performance in the electronics supply chain industry.
- Select and implement ISO 9001 documentation protocols for standardized quality management in aerospace component fabrication.
- Experiment with Taguchi quality loss function modeling to boost design robustness of automotive suspension systems.

- Solve FMEA-based risk assessment scenarios to prioritize maintenance actions in power generation plants.

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,

Reference Books:

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.

Online Learning Resources:

- https://nptel.ac.in/courses/101108661
- https://www.youtube.com/watch?v=iJnuTtUFiWM

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B.Tech. IV Year I Semester

Gender Sensitization
(Audit Course)

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0054T	2:0:0	0	CIE:30	3 Hours	MC

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

- 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.

Syllabus		Total Hours:24
Unit-I	**Understanding Gender**	**5Hrs**
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-II	**Gender Roles and Relations**	**5Hrs**
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-III	**Gender and Labour**	**5Hrs**
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-IV	**Gender-Based Violence**	**5Hrs**
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-V	**Gender and Culture**	**4Hrs**
Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues- Gender Sensitive Language- Just Relationships		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand the basic concepts of gender and its related terminology L1, L2,
- Identify the biological, sociological, psychological and legal aspects of gender.
- Use the knowledge in understanding how gender discrimination works in our society and how to counter it.
- Analyze the gendered division of labour and its relation to politics and economics.
- Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups
- Develop students‗ sensibility with regard to issues of gender in contemporary India

Text 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 Learning Resources:

Understanding Gender chrome-extension:

- https://www.arvindguptatoys.com/arvindgupta/kamlagender1.pdf
- https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

Gender Roles and Relations

- https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-genderroles-and-stereotypes
- https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408
- https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

Gender and Labour

- https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-canit-be-redressed
- https://onlinecourses.nptel.ac.in/noc23_mg67/preview

Gender-Based Violence

- https://eige.europa.eu/gender-based-violence/what-is-gender-basedviolence?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

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/
- the content of Sohaila Abdulali’s “I Fought For My Life…and Won”

(http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

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B.Tech. IV Year I Semester

Building Materials and Services

(CSE, AI&ML, CS, DS,ECE, EEE, ME)

Open Elective – III

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0152T	3:0:0	3	CIE:30 SEE:70	3 Hours	OE

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

- To understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
- To Analyse the composition, manufacturing process, and properties of cement and admixtures.
- To apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
- To evaluate masonry, mortars, finishing techniques, and formwork systems.
- To assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

Syllabus		Total Hours:42
Unit-I	**Stones and Bricks, Tiles**	**8Hrs**

Building Stones – Classifications and Quarrying – Properties – Structural Requirements – Dressing. Bricks – Composition of Brick Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics. Timber, Aluminum, Glass, Paints and Plastics: Wood - Structure – Types and Properties – Seasoning – Defects; Alternate Materials for Timber – GI / Fibre – Reinforced Glass Bricks, Steel & Aluminum, Plastics.

Unit-II	**Cement &Admixtures**	**9Hrs**

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**	**9Hrs**

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, Masonry and Finishing‘s Mortars**	**8Hrs**

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**	**8Hrs**

Plumbing Services: Water Distribution, Sanitary – Lines &Fittings;
Ventilations: Functional Requirements Systems of Ventilations. Air-Conditioning - Essentials and Types; Acoustics – Characteristic – Absorption – Acoustic Design; Fire Protection – Fire Hazards – Classification of Fire Resistant Materials and Constructions.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.

- Analyse the composition, manufacturing process, and properties of cement and admixtures.
- Apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
- Evaluate masonry, mortars, finishing techniques, and formwork systems.
- Assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

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.

Reference 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/**

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B.Tech. IV Year I Semester

Environmental Impact Assessment

Open Elective – III

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0121T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OE**

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

- Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
- Analyse the impact of developmental activities on land use, soil, and water resources.
- Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
- Develop environmental audit procedures and assess compliance with environmental regulations.
- Understand and apply environmental acts, notifications, and legal frame works in EIA studies.

Syllabus		Total Hours:42
Unit-I	**Concepts and methodologies of EIA**	**8Hrs**

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**	**9Hrs**

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**	**9Hrs**

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**	**8Hrs**

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**	**8Hrs**

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, Concept of ISO and ISO 14000.

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Apply various methodologies for conducting Environmental Impact Assessments.
- Analyse the impact of land-use changes on soil, water, and air quality.
- Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
- Develop environmental audit reports and assess compliance with environmental policies.
- Interpret and apply environmental acts and regulations related to EIA.

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)

Reference 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/**

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B.Tech. IV Year I Semester

SMART GRID TECHNOLOGIES Open Elective – III					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0241T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- To understand the evolution of electric grids and the necessity of Smart Grids, by comparing conventional systems with modern smart grids, studying enabling technologies, international deployment experiences, and India's Smart Grid road map and architecture.
- To gain knowledge of Wide Area Monitoring Systems (WAMS) through the fundamentals of synchrophasor technology, structure and operation of PMUs and PDCs, applications in blackout analysis, and case studies on real-time system monitoring and control.
- To study the features, types, and functional specifications of Smart Meters, and to analyze AMR and AMI systems, their drivers, benefits, protocols, and applications in demand-side management such as peak load, outage, and power quality management.
- To acquire an understanding of information and communication technologies in Smart Grids, covering communication system requirements, modulation and demodulation techniques, and technologies like Radio, Mobile, Power Line, and Optical Fibre Communication along with smart grid protocols.
- To explore Smart Grid applications and integration of emerging energy technologies, such as renewable energy systems, distributed generation, protective relaying, home area networks, advanced energy storage technologies, and Plug-in Hybrid Electric Vehicles.
- To identify, assess, and address cybersecurity challenges in Smart Grids, focusing on risks in AMI, DG, automation, and EV management systems, while studying methodologies, security requirements, and Smart Grid Information Models for secure operations.

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Introduction to Smart Grid**	**10Hrs**

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**	**9Hrs**

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**	**10Hrs**

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	10Hrs
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	9Hrs
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.		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understanding the Concept and Evolution of Smart Grids.
- Analyzing Wide Area Monitoring System and Synchrophasor Technology.
- Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts.
- Evaluating Information and Communication Technology (ICT) Systems in Smart Grids.
- Designing Smart Grid Applications and Cybersecurity Measures.

Textbooks:

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.

Reference Books:

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013. *B.Tech - CSE R23 Regulation* 149
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.

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B.Tech. IV Year I Semester

INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLERS Open Elective – III					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0416T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- To learn the fundamental architectural concepts of microprocessors.
- To gain knowledge about assembly language programming concepts.
- To get familiar about 8086 interfacing.
- To understand the fundamentals of the 8051 Microcontroller.
- To learn interfacing with the 8051 Microcontroller.

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Microprocessor**	**10Hrs**

Microprocessor: Introduction to Microprocessors**,** Main features of 8086 Microprocessor, 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**	**9Hrs**

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**	**10Hrs**

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**	**10Hrs**

Microcontroller: Introduction to RISC Processors, Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

Unit -V	**Interfacing Microcontroller**	**9Hrs**

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 and Microcontroller.

Course Outcomes(CO):

After the completion of the course students will able to:

- Learn the fundamental architectural concepts of microprocessors.
- Gain knowledge about assembly language programming concepts.
- Understand the concepts of 8086 interfacing.
- Learn the fundamentals of the 8051 Microcontroller.

- Know the interfacing with the 8051 Microcontroller.
- Understand the concepts of interfacing 8051 Microcontroller.

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 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.

Reference Books:

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.

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B.Tech. IV Year I Semester

DATABASE MANAGEMENT SYSTEMS
Open Elective – III

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0512T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- 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

Syllabus		Total Hours: 48Hrs
Unit-I	**Entity Relationship Model**	**10Hrs**

Introduction: Data base 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**	**9Hrs**

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 Data base schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

Unit -III	**SQL**	**10Hrs**

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**	**10Hrs**

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**	**9Hrs**

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:

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand the basic concepts of database management systems
- Analyze a given database application scenario to use ER model for conceptual design of the database
- Utilize SQL proficiently to address diverse query challenges
- Employ normalization methods to enhance database structure
- Assess and implement transaction processing, concurrency control and database recovery protocols in databases.

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

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B.Tech. IV Year I Semester

CYBER SECURITY
Open Elective – III

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0532T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

The objectives of the course are to make the students learn about:
The course is designed to provide awareness on different cyber-crimes, cyber offenses, tools and methods used in cybercrime.

Syllabus		Total Hours: 48Hrs
Unit-I	**Introduction to Cybercrime**	**10Hrs**

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**	**9Hrs**

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**	**10Hrs**

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**	**10Hrs**

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**	**9Hrs**

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.

Course Outcomes(CO):

After the completion of the course students will able to:

- Classify the cybercrimes and understand the Indian ITA 2000
- Analyse the vulnerabilities in any computing system and find the solutions
- Predict the security threats of the future
- Investigate the protection mechanisms
- Design security solutions 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. David Irwin.CRC Press T&F Group

Web Resources:

1. http://nptel.ac.in/courses/106105031/40
2. http://nptel.ac.in/courses/106105031/39
3. http://nptel.ac.in/courses/106105031/38

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B.Tech. IV Year I Semester

Wavelet Transforms and Its Applications
Open Elective – III

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0031T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To introduce the fundamentals of wavelets, wavelet expansion, and transform techniques.
- To understand multiresolution analysis, scaling functions, and wavelet functions.
- To apply filter banks for analysis and synthesis in discrete wavelet transform.
- To analyze time-frequency characteristics and computational aspects of wavelet transforms.
- To study orthogonal, biorthogonal bases, frames, and their matrix representations.
- To develop problem-solving skills by applying wavelet methods to signal analysis and processing.

Syllabus		Total Hours: 48Hrs
Unit-I	Wavelets	10Hrs
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	9Hrs
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	10Hrs
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	10Hrs
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	9Hrs
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.		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms
- Illustrate the multi resolution analysis ad scaling functions.
- Implement discrete wavelet transforms with multirate digital filters
- Understand multi resolution analysis and identify various wavelets and evaluate their time-frequency resolution properties.
- Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields

Textbooks:

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)..

Reference Books:

1. RaghuveerRao, “Wavelet Transforms”, Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

Web Resources:

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-ofwaveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf

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B.Tech. IV Year I Semester

SMART MATERIALS AND DEVICES
Open Elective – III

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0036T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To provide exposure to smart materials and their engineering applications.
- To impart knowledge on the basics and phenomenon behind the working of smart materials
- To explain the properties exhibited by smart materials
- To educate various techniques used to synthesize and characterize smart materials
- To identify the required smart material for distinct applications/devices

Syllabus		Total Hours: 48Hrs
Unit-I	**Introduction to Smart Materials**	**10Hrs**

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**	**9Hrs**

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

Unit -III	**Synthesis of Smart Materials**	**10Hrs**

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**	**10Hrs**

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**	**9Hrs**

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Course Outcomes(CO):

After the completion of the course students will able to:

- Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.
- Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.
- Summarize various types of synthesis of smart materials.
- Analyze various characterization techniques used for smart materials.
- Interpret the importance of smart materials in various 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

Web Resources:

1. **NPTEL course link: https://onlinecourses.nptel.ac.in/noc22_me17/preview**

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B.Tech. IV Year I Semester

Introduction to Quantum Mechanics
Open Elective – III

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0037T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- To understand the fundamental differences between classical and quantum mechanics.
- To study wave-particle duality, uncertainty principle, and their implications.
- To learn and apply Schrödinger equations to basic quantum systems.
- To use operator formalism and mathematical tools in quantum mechanics.
- To explore angular momentum, spin and their quantum mechanical representations.

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Principles of Quantum Mechanics**	**10Hrs**

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**	**9Hrs**

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**	**10Hrs**

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**	**10Hrs**

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**	**9Hrs**

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.

Course Outcomes(CO):

After the completion of the course students will able to:

- Explain the key principles of quantum mechanics and wave-particle duality.
- Apply Schrödinger equations to solve one-dimensional quantum problems.
- Solve quantum mechanical problems using operator and matrix methods.
- Evaluate quantum states using Dirac notation and expectation values.
- Analyze angular momentum and spin systems using Pauli matrices and operators.

Textbooks:

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.

Web Resources:

1. https://archive.nptel.ac.in/courses/115/101/115101107/
2. https://archive.nptel.ac.in/courses/122/106/122106034/
3. https://nptel.ac.in/courses/115106066

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B.Tech. IV Year I Semester

Green Chemistry and Catalysis for Sustainable Environment
Open Elective – III

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0042T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To Understand Principle And Concepts Of Green Chemistry.
- To Understand The Types Of Catalysis And Industrial Applications.
- To Apply Green Solvents In Chemical Synthesis.
- To Enumerate Different Sourced Of Green Energy.
- To Apply Alternative Greener Methods Foe Chemical Reactions

Syllabus		Total Hours: 48Hrs
Unit-I	**Principles and Concepts of Green Chemistry**	**10Hrs**

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-II	**Catalysis and Green Chemistry**	**9Hrs**

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 -III	**Green Solvents in Chemical Synthesis**	**10Hrs**

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 -IV	**Emerging Greener Technologies**	**10Hrs**

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 -V	**Alternative Greener Methods**	**9Hrs**

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.

Course Outcomes(CO):

After the completion of the course students will able to:

- 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.
- 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
- Demonstrate Green solvents and importance, Discuss Supercritical carbondioxide, Explain Supercritical water, recycling of green solvents.
- Describe importance of Biomass and Solar Power, Illustrate Sonochemistry, Apply Green

Chemistry for Sustainable Development; discuss the importance of Renewable resources, mechanochemical synthesis.

- Discuss Alternative green methods like Photoredox catalysis, single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Textbooks:

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

Reference Books:

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.

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B.Tech. IV Year I Semester

Employability Skills
Open Elective – III

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0046T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- 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

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Goal Setting and Self-Management**	**10Hrs**
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**	**9Hrs**
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**	**10Hrs**
Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation		
Unit -IV	**Group Presentation Skills**	**10Hrs**
Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation-Group Discussion-Debate –Corporate Etiquette		
Unit -V	**Job Cracking Skills**	**9Hrs**
Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews		

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand the importance of goals and try to achieve them.
- Explain the significance of self-management.
- Apply the knowledge of writing skills in preparing eye-catchy resumes.
- Analyse various forms of Presentation skills.
- Judge the group behaviour appropriately.
- Develop skills required for employability.

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:

- https://youtu.be/gkLsn4ddmTs
- https://youtu.be/2bf9K2rRWwo
- https://youtu.be/FchfE3c2jzc
- https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
- https://www.youtube.com/c/skillopedia/videos
- https://onlinecourses.nptel.ac.in/noc25_hs96/preview
- https://onlinecourses.nptel.ac.in/noc21_hs76/preview
- https://archive.nptel.ac.in/courses/109/107/109107172/#
- https://archive.nptel.ac.in/courses/109/104/109104107/

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B.Tech. IV Year I Semester

Geo-Spatial Technologies
Open Elective – IV

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0153T	3:0:0	3	CIE:30 SEE:70	3 Hours	OE

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

- To understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
- To Analyse vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
- To apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
- To evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
- To assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

Syllabus		Total Hours:42
Unit-I	**Raster Analysis**	**8Hrs**
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**	**9Hrs**
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**	**9Hrs**
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**	**8Hrs**
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	**Customization, Web GIS, Mobile Mapping**	**8Hrs**
Customization 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.		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.

- Analyse vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
- Apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
- Evaluate surface and geostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
- Assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

Text Books:

1. Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008.
2. Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

Reference 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**

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B.Tech. IV Year I Semester

Solid Waste Management
Open Elective – IV

Course Code	L:T:P	Credits	Exam Marks	Exam Duration	Course Type
23A0154T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**OE**

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

- To understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
- To Analyse engineering systems for solid waste collection, storage, and transportation.
- To apply resource and energy recovery techniques for sustainable solid waste management.
- To evaluate landfill design, construction, and environmental impact mitigation strategies.
- To assess hazardous waste management techniques, including biomedical and e-waste disposal.

Syllabus		**Total Hours:42**
Unit-I	**Solid Waste**	**8Hrs**
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 Systems for Solid Waste Management**	**9Hrs**
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**	**9Hrs**
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**	**8Hrs**
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**	**8Hrs**
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		

Course Outcomes(CO):

Upon completion of this course, students should be able to:

- Understand the types, sources, and characteristics of solid waste, along with Regulatory frameworks.
- Analyze engineering systems for solid waste collection, storage, and transportation.
- Apply resource and energy recovery techniques for sustainable solid waste Management..
- Evaluate landfill design, construction, and environmental impact mitigation strategies
- Assess hazardous waste management techniques, including biomedical and e-waste.

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.

Reference Books:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, _Environmental Engineering', McGraw Hill Inc., New York, 2017.
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/**

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B.Tech. IV Year I Semester

Electric Vehicles
Open Elective – IV

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0242T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- 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

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Introduction to EV Systems and Energy Sources**	**10Hrs**

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**	**9Hrs**

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**	**10Hrs**

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**	**10Hrs**

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**	**9Hrs**

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

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.

- Understand Various dynamics of Electric Vehicles.
- Understand various configurations in parameters of EV system and dynamic aspects of EV.
- Analyze fuel cell technologies in EV and HEV systems.
- Analyze the battery charging and controls required of EVs.

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

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B.Tech. IV Year I Semester

TRANSDUCERS AND SENSORS
Open Elective – IV

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0444T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To understand characteristics of Instrumentation System and the operating principle of motion transducers.
- To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
- To provide knowledge on flow transducers and their applications.
- To study the working principles of pressure transducers.
- To introduce working principle and applications of force and sound transducers.

Syllabus		Total Hours: 48Hrs
Unit-I	**Introduction & Motion Transducers**	**10Hrs**

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	9Hrs

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	10Hrs

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	10Hrs

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	9Hrs

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone**.** Inductive sensor, Capacitive sensors, Thermal sensors.

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand characteristics of Instrumentation System and the operating principle of motion transducers.
- Explore working principles, and applications of different temperature transducers
- Gain knowledge on flow transducers and their applications.
- Learn the working principles of pressure transducers.
- Understand the working principle and applications of force and sound transducers.
- Explore working principles, and applications of Piezo-electric sensors.

Textbooks:
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.

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B.Tech. IV Year I Semester

COMPUTER NETWORKS & INTERNET PROTOCOLS Open Elective – IV					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0520T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- 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

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Computer Networks and the Internet**	**10Hrs**
What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks(Textbook 2), Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission (Textbook 1)		
Unit-II	**The Data Link Layer, Access Networks, and LANs**	**9Hrs**
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 Request (Textbook 2)		
Unit -III	**The Network Layer**	**10Hrs**
Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1).		
Unit -IV	**The Transport Layer**	**10Hrs**
Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1).		
Unit -V	**The Application Layer**	**9Hrs**
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).		

Course Outcomes(CO):

After the completion of the course students will able to:

- Identify the software and hardware components of a computer network
- Design software for a computer network
- Develop new 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

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, Datacommunications and Networking, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akthar, ―Networks for Computer Scientists and Engineers‖, Oxford Publishers, 2016.

Web References:

1. https://nptel.ac.in/courses/106105183/25
2. http://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

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B.Tech. IV Year I Semester

INTERNET OF THINGS
Open Elective – IV

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0450T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

Syllabus		Total Hours: 48Hrs
Unit-I	**Introduction to IoT**	**10Hrs**

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**	**9Hrs**

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**	**10Hrs**

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**	**10Hrs**

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**	**9Hrs**

Introduction to Unmanned 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.

Course Outcomes(CO):

After the completion of the course students will 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

Textbooks:

1. Vijay Madisetti and Arshdeep Bahga, ― 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, Vlasios Tsiatsis, 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 Connecing Everything‖, 1st Edition, Apress Publications, 2013 5. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 9781- 4493-9357- 6. DGCA RPAS Guidance Manual, Revision 3 – 2020 7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal
Web References: 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

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B.Tech. IV Year I Semester

INTRODUCTION TO QUANTUM COMPUTING Open Elective – IV					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A3315a	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- 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.

Syllabus		**Total Hours: 48Hrs**
Unit-I	**Fundamentals of Quantum Mechanics and Linear Algebra**	**10Hrs**
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**	**9Hrs**
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**	**10Hrs**
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**	**10Hrs**
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**	**9Hrs**
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.		

Course Outcomes(CO):

After the completion of the course students will 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.

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.

Web References:

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

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B.Tech. IV Year I Semester

FINANCIAL MATHEMATICS
Open Elective – IV

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0032T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To provide mathematical foundations for financial modelling, risk assessment and asset pricing.
- To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
- To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
- To equip students with computational techniques for pricing financial derivatives.

Syllabus		Total Hours: 40Hrs
Unit-I	Asset Pricing and Risk Management	8Hrs

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	8Hrs

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	8Hrs

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	8Hrs

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	8Hrs

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.

Course Outcomes(CO):

After the completion of the course students will able to:

- Explain fundamental financial concepts, including arbitrage, valuation, and risk.
- Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.
- Analyze mathematical techniques for pricing options and financial derivatives.
- Evaluate interest rate models and bond pricing methodologies.
- Utilize computational techniques such as Monte Carlo simulations for financial modeling.

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: 1. MIT– Mathematics for Machine Learning https://ocw.mit.edu 2. Coursera – Financial Engineering and Risk Management (Columbia University) https://www.coursera.org/ 3. National Stock Exchange (NSE) India – Financial Derivatives https://www.nseindia.com/

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B.Tech. IV Year I Semester

SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS
Open Elective – IV

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0038T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To provide exposure to various kinds of sensors and actuators and their engineering applications.
- To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
- To explain the operating principles of various sensors and actuators
- To educate the fabrication of sensors
- To explain the required sensor and actuator for interdisciplinary application

Syllabus		Total Hours: 40Hrs
Unit-I	**Introduction to Sensors and Actuators**	**8Hrs**

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**	**8Hrs**

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**	**8Hrs**

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**	**8Hrs**

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**	**8Hrs**

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)

Course Outcomes(CO):

After the completion of the course students will able to:

- Classify different types of Sensors and Actuators along with their characteristics
- Summarize various types of Temperature and Mechanical sensors
- Illustrates various types of optical and mechanical sensors
- Analyze various types of Optical and Acoustic Sensors

- Interpret the importance of smart materials in various devices

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.

Web References:

1. **NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview**

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B.Tech. IV Year I Semester

CHEMISTRY OF NANOMATERIALS AND APPLICATIONS
Open Elective – IV

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
23A0043T	3:0:0	3	CIE:30 & SEE:70	3 Hours	OE

Course Objectives:

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

- To understand basics and characterization of nanomaterials.
- To understand synthetic methods of nanomatrials.
- To apply various techniques for charterization of nanomaterials.
- To understand Studies of Nano-structured Materials
- To enumerate the applications of advanced nanomaterials in engineering

Syllabus		Total Hours: 40Hrs
Unit-I	Basics and Characterization of Nanomaterials	8Hrs

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	8Hrs

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	8Hrs

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	8Hrs

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	8Hrs

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.

Course Outcomes(CO):

After the completion of the course students will able to:

- Classify the nanostructure materials; describe scope of nanoscience and importance technology.
- 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.
- Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis.
- Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and

carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.

- 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.

Textbooks:

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.

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B.Tech. IV Year I Semester

LITERARY VIBES **Open Elective – IV**					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0047T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**OE**

Course Objectives:

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

- To inculcate passion for aesthetic sense and reading skills
- To encourage respecting others‘ experiences and creative writing
- To explore emotions, communication skills and critical thinking
- To educate how books serve as the reflection of history and society
- To provide practical wisdom and duty of responding to events of the times

Syllabus		**Total Hours: 40Hrs**
Unit-I	**Poetry**	**8Hrs**
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**	**8Hrs**
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**	**8Hrs**
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**	**8Hrs**
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**	**8Hrs**
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		

Course Outcomes(CO):

After the completion of the course students will able to:

- Identify genres, literary techniques and creative uses of language in literary texts.

- Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces
- Apply knowledge and understanding of literary texts when responding to others‘ problems and their own and make evidence-based arguments
- Analyze the underlying meanings of the text by using the elements of literary texts L4
- Evaluate their own work and that of others critically
- Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance

Textbooks:

1. Charles Dickens.Hard Times.(Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC.William Shakespeare. Twelfth Night. Oxford University Press,2016.

Reference Books:

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/