B.Tech. I Year I Semester

S. No.	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	23FE01	Communicative English	2	0	0	2	30	70	100
2	23FE03	Linear Algebra & Calculus	3	0	0	3	30	70	100
3	23FE04	Engineering Physics	3	0	0	3	30	70	100
4	23CM01	Basic Civil and Mechanical Engineering	3	0	0	3	30	70	100
5	23ME01	Engineering Graphics	2	0	2	3	30	70	100
Laboratory Courses									
6	23FE51	Communicative English Lab	0	0	2	1	30	70	100
7	23FE53	Engineering Physics Lab	0	0	2	1	30	70	100
8	23IT51	IT Workshop	0	0	2	1	30	70	100
9	23ME51	Engineering Workshop	0	0	3	1.5	30	70	100
10	23AU02	NSS/NCC/Scouts and Guides/Community Service	0	0	1	0.5	100	--	100
Total			**13**	**0**	**12**	**19**	**370**	**630**	**1000**

B.Tech. I Year II Semester

S. No.	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	23FE05	Differential Equations & Vector Calculus	3	0	0	3	30	70	100
2	23FE06	Engineering Chemistry	3	0	0	3	30	70	100
3	23EE01	Basic Electrical & Electronics Engineering	3	0	0	3	30	70	100
4	23CS01	Introduction to Programming	3	0	0	3	30	70	100
5	23ME02	Engineering Mechanics	3	0	0	3	30	70	100
Laboratory Courses									
6	23FE54	Engineering Chemistry Lab	0	0	2	1	30	70	100
7	23EE51	Electrical & Electronics Engineering Workshop	0	0	3	1.5	30	70	100
8	23CS51	Computer Programming Lab	0	0	3	1.5	30	70	100
9	23ME52	Engineering Mechanics Lab	0	0	3	1.5	30	70	100
10	23AU01	Health and wellness, Yoga and sports	0	0	1	0.5	100	--	100
Total			**15**	**0**	**12**	**21**	**370**	**630**	**1000**

B.Tech. II Year I Semester

S. No.	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	23FE09	Numerical Methods and Transform Techniques	3	0	0	3	30	70	100
2	23HS01	UHV – 2 Understanding Harmony and Ethical Human Conduct	2	1	0	3	30	70	100
3	23AE01	Introduction to Aerospace Engineering	2	0	0	2	30	70	100
4	23AE02	Engineering Fluid Mechanics	3	0	0	3	30	70	100
5	23AE03	Engineering Thermodynamics	3	0	0	3	30	70	100
6	23MC01	Environmental Science	2	0	0	-	30	-	-
Laboratory Courses									
7	23AE51	Engineering Fluid Mechanics Lab	0	0	3	1.5	30	70	100
8	23AE52	Applied Thermodynamics Lab	0	0	3	1.5	30	70	100
9	23CS57	Python Programming Lab	0	0	2	1	30	70	100
10	23AES1	Computer Aided Design Lab	0	1	2	2	30	70	100
Total			**15**	**2**	**10**	**20**	**300**	**630**	**930**

B.Tech. II Year II Semester

S. No.	Course Code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	23HS03	Industrial Management	2	0	0	2	30	70	100
2	23FE13	Complex variables, Probability and Statistics	3	0	0	3	30	70	100
3	23AE04	Materials and Manufacturing Technology	3	0	0	3	30	70	100
4	23AE05	Solid Mechanics	3	0	0	3	30	70	100
5	23AE06	Aerodynamics	3	0	0	3	30	70	100
Laboratory Courses									
6	23AE53	Manufacturing Technology Lab	0	0	3	1.5	30	70	100
7	23AE54	Solid Mechanics Lab	0	0	3	1.5	30	70	100
8	23AES2	MATLAB applications in Engineering Lab	0	1	2	2	30	70	100
9	23ME57	Design Thinking and Innovation	1	0	2	2	30	70	100
Total			**15**	**1**	**10**	**21**	**270**	**630**	**900**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation									

V SEMESTER

S. No.	Course code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	23AE07	Aerospace Vehicle Structures	3	0	0	3	30	70	100
2	23AE08	Gas Dynamics	3	0	0	3	30	70	100
3	23AE09	Aircraft Systems and Instruments	3	0	0	3	30	70	100
4	23AE10	Industrial Aerodynamics	3	0	0	3	30	70	100
	23AE11	Finite Element Analysis							
	23AE12	UAV Systems Design							
	23AE13	Computer Aided Design and Manufacturing							
5	OE-I		3	0	0	3	30	70	100
Laboratory Courses									
6	23AE55	Aerodynamics Lab	0	0	3	1.5	30	70	100
7	23AE56	Aircraft Component Modelling using CATIA	0	0	3	1.5	30	70	100
8	23AES3	Computational Structural Analysis Lab	0	1	2	2	30	70	100
9	23EM01	Tinkering Lab	0	0	2	1	30	70	100
10	23PI01	Evaluation of Community Service Internship	-	-	-	2	-	50	50
Total			**15**	**1**	**10**	**23**	**270**	**680**	**950**

VI SEMESTER

S. No.	Course code	Course Title	Contact hours/week			Credits	Scheme of Valuation		
			L	T	P		CIE	SEE	Total
Theory Courses									
1	23AE14	Aircraft Structures and Vibrations	3	0	0	3	30	70	100
2	23AE15	Air Breathing Propulsion	3	0	0	3	30	70	100
3	23AE16	Flight Dynamics	3	0	0	3	30	70	100
4	23AE17	Computational Fluid Dynamics and Heat Transfer	3	0	0	3	30	70	100
	23AE18	Air Traffic Services and Aerodrome Design							
	23AE19	Non-Destructive Testing							
	23AE20	Flight Vehicle Design							
5	23AE21	Helicopter Aerodynamics	3	0	0	3	30	70	100
	23AE22	Experimental Stress Analysis							
	23AE23	Instrumentation Measurements and Experiments in Fluids							
	23AE24	Introduction to Smart Structures							
6	OE-II		3	0	0	3	30	70	100
Laboratory Courses									
7	23AE57	Aircraft Structures Lab	0	0	3	1.5	30	70	100
8	23AE58	Propulsion Lab	0	0	3	1.5	30	70	100
9	23HSS1	Soft Skills	0	1	2	2	30	70	100
10	23MC02	Technical Paper Writing & IPR	2	0	0	-	30	-	30
Total			**20**	**1**	**8**	**23**	**300**	**630**	**930**
Mandatory Industry Internship of 08 weeks duration during summer vacation									

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

OPEN ELECTIVES

Course Code	Course Name	Offered to the branches
23AD81	Introduction to Artificial Intelligence	ASE, CE, ECE,EEE & ME
23AD82	Fundamentals of Data Science	ASE, CE, ECE,EEE & ME
23AD83	Introduction to Cloud Computing	ASE, CE, ECE,EEE & ME
23AD84	Data Analytics	ASE, CE, ECE,EEE & ME
23AE81	PRINCIPLES OF FLIGHT	AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23AE82	SPACE SCIENCE	AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23AE83	AIRCRAFT INSTRUMENTATION	AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23AE84	AIR TRANSPORTATION SYSTEMS	AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23AM81	Python Programming for AI & ML	ASE, CE, ECE,EEE & ME
23AM82	AI in healthcare	ASE, CE, ECE,EEE & ME
23AM83	Fundamentals of Machine Learning	ASE, CE, ECE,EEE & ME
23AM84	Introduction to Deep learning	ASE, CE, ECE,EEE & ME
23CE81	Disaster Management	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE82	Climate change impact on Eco system	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE83	Environmental Sanitation	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE84	Introduction to Remote Sensing and GIS	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE85	Water Supply Systems	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CE86	Sustainability in Engineering Practices	ASE,AI&DS,CSE, CSE(AI&ML), ECE,EEE,IT & ME
23CS81	Introduction to Java Programming	ASE, CE, ECE,EEE & ME
23CS82	Principles of Operating Systems	ASE, CE, ECE,EEE & ME
23CS83	Principles of Database Management Systems	ASE, CE, ECE,EEE & ME
23CS83	Principles of Database Management Systems	ASE, CE, ECE,EEE & ME
23CS84	IoT based smart Systems	ASE, CE, ECE,EEE & ME
23EC81	Linear and Digital IC Applications	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME
23EC82	Principles of communications	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME
23EC83	Fundamentals of VLSI Design	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME
23EC84	Principles of Cellular & Mobile communications	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME
23EC85	Fundamentals of Satellite Communications	ASE,AI&DS, CE,CSE, CSE(AI&ML), EEE,IT & ME

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

Course Code	Course Name	Offered to the branches
23EE81	Basic Control System	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE82	Basic Electrical Measurements	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE83	Utilization of Electrical Energy	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE84	Electric Vehicles	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE85	Concepts of Energy Auditing & Management	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23EE86	Electrical Wiring Estimation and Costing	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,IT & ME
23IT81	Computer System Architecture	ASE, CE, ECE,EEE & ME
23IT82	Introduction to Programming in Java	ASE, CE, ECE,EEE & ME
23IT83	Principles of Software Engineering	ASE, CE, ECE,EEE & ME
23ME81	Sustainable Energy Technologies	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME82	Introduction to Industrial Robotics	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME83	Applied Operations Research	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME84	Entrepreneurship	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME85	Additive Manufacturing	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT
23ME86	Vehicle Technology	ASE,AI&DS, CE,CSE, CSE(AI&ML), ECE,EEE & IT

L	T	P	C
2	0	0	2

I Year I Semester

23FE01-COMMUNICATIVE ENGLISH

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the context, topic, and pieces of specific information from social or Transactional dialogues.	**Understand**
CO2	Apply grammatical structures to formulate sentences and correct word forms.	**Apply**
CO3	Use discourse markers to speak clearly on a specific topic in informal discussions.	**Apply**
CO4	Read / Listen the texts and write summaries based on global comprehension of these texts.	**Understand**
CO5	Prepare a coherent paragraph, essay, and resume.	**Apply**

UNIT I

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

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

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

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

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

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

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

UNIT II

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

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

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

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

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

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

Vocabulary: Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what isdiscussed

Reading: Reading a text in detail by making basic inferences -recognizing and interpretingspecific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in 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

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

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar andusage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

TEXT BOOKS:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, OrientBlack 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 UniversityPress, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Online Learning Resources:

GRAMMAR:

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

VOCABULARY

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

L	T	P	C
3	0	0	3

I Year I Semester

23FE03- LINEAR ALGEBRA AND CALCULUS

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply matrix algebra techniques to solve engineering problems.	**Apply**
CO2	Use Eigen values and Eigen vectors concept to find nature of quadratic form, inverse and powers of matrix.	**Apply**
CO3	Expand various functions using Mean value theorems.	**Understand**
CO4	Understand the concepts of functions of several variables which are useful in optimization.	**Understand**
CO5	Evaluate areas and volumes by using double and triple integrals.	**Apply**

UNIT I Matrices

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 by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II Eigenvalues, Eigenvectors and Orthogonal Transformation

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 canonicalforms by Orthogonal Transformation.

UNIT III Calculus

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

UNIT IV Partial Differentiation and Applications (Multi variable calculus) Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V Multiple Integrals (Multi variable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar,

cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

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, PearsonPublishers, 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)

I Year I Semester

23FE04- ENGINEERING PHYSICS

(Common to All Branches of Engineering)

L	T	P	C
3	0	0	3

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.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Analyze the intensity variation of light due to interference, diffraction, and Polarization	**Apply**
CO2	Understand the basics of crystals and their structures	**Understand**
CO3	Summarize various types of polarization of dielectrics and classify the magnetic materials	**Understand**
CO4	Explain fundamentals of quantum mechanics and free electron theory of metals	**Understand**
CO5	Identify the type of semiconductor using Hall Effect	**Apply**

UNIT I Wave Optics

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

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

UNIT II Crystallography and X-ray diffraction

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

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

UNIT III Dielectric and Magnetic Materials

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

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

UNIT IV Quantum Mechanics and Free electron Theory

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

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

UNIT V Semiconductors

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

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)

REFERENCE BOOKS:

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

Online Learning Resources:

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

L	T	P	C
3	0	0	3

I Year I Semester

23CM01- BASIC CIVIL AND MECHANICAL ENGINEERING

(Common to All Branches of Engineering)

PART A: BASIC CIVIL ENGINEERING

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Describe various sub-divisions of Civil Engineering and to appreciate their role in societal development.	Understand
CO2	Outline the concepts of surveying and obtain the theoretical measurement of distances,angles and levels through surveying.	Understand
CO3	Classify the various materials used in construction and highway engineering and identifytheir appropriate usage as per the needs.	Understand
CO4	Illustrate the fundamental principles involved in transportation network system, theirindividual components and their engineering importance.	Understand
CO5	Explain the quality parameters of various water sources and functions of selected water storage and conveyance structures.	Understand

UNIT I

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

UNIT II

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

UNIT III

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

PART B: BASIC MECHANICAL ENGINEERING

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO6	Summarize the different manufacturing processes.	**Remember**
CO7	Explain the basics of thermal engineering and its applications.	**Understand**
CO8	Illustrate the working of different mechanical power transmission systems and power plants.	**Understand**
CO9	Describe the basics of robotics and its applications.	**Understand**

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – Working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission - Belt Drives, Chain, 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.)

TEXT BOOKS:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India)Pvt. Ltd.
2. A text 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, Cengagelearning India Pvt. Ltd.

REFERENCE BOOKS:

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

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I Year I Semester

23ME01- ENGINEERING GRAPHICS

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.	**Understand**
CO2	Draw and interpret orthographic projections of points, lines, planes and solids in front, topand side views.	**Apply**
CO3	Understand and draw projection of solids in various positions in first quadrant.	**Apply**
CO4	Able to draw the development of surfaces of simple objects	**Apply**
CO5	Prepare isometric and orthographic sections of simple solids.	**Apply**

UNIT I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods. **(Covered theoretically in class. Not for the end examination)**

Scales: Plain scales, diagonal scales and vernier scales. **(Covered theoretically in class. Not for the endexamination)**

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

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

UNIT II

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

Projections of Planes: Regular planes Perpendicular to both reference planes, parallel to one

reference plane and inclined to the other reference plane.

UNIT III

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

UNIT IV

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

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

UNIT V

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

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

Textbook:

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

Reference Books:

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

I Year I Semester

23FE51- COMMUNICATIVE ENGLISH LAB

(Common to All Branches of Engineering)

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Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the different aspect of the English language proficiency with emphasis on LSRW skills.	**Understand**
CO2	Apply Communication Skills through various language learning activities.	**Apply**
CO3	Identifying the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking, comprehension.	**Understand**
CO4	Exhibit professionalism in participating in debates and group discussions.	**Apply**

List of Topics:

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

Suggested Software:

- Walden Infotech
- Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India,2016
3. Hewing's, Martin. Cambridge *Academic English* (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed),Kindle, 2013

Online Resources:

Spoken English:

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

Voice & Accent:

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

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I Year I Semester

23FE53- ENGINEERING PHYSICS LAB

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Analyze the wave properties of light using optical instruments	**Apply**
CO2	Estimate the elastic modulii of various materials and acceleration due to gravity	**Apply**
CO3	Demonstrate the vibrations in stretched strings	**Understand**
CO4	Evaluate dielectric constant and magnetic field of circular coil carrying current	**Apply**
CO5	Examine the characteristics of semiconductor devices	**Apply**

List of Experiments:

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

experiment.

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

References:

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

Online Resources

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

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I Year I Semester

23IT51- IT WORKSHOP

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Identify the components of a PC and troubleshooting the malfunctioning of PC.	**Apply**
CO2	Develop presentation /documentation using Office tools and LaTeX.	**Apply**
CO3	Build dialogs and documents using ChatGPT.	**Apply**
CO4	Improve individual / teamwork skills, communication and report writing skills with ethical values.	**Apply**

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 throughthe 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 bothWindows 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 configuredas 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. Finallystudents

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 WWWon the LAN.

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

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

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

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Usinghelp 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 TeXand 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 helpand 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 sentencesto 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 storyor 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 tosee how accurate and fluent the translations are.

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

REFERENCE BOOKS:

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

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I Year I Semester

23ME51- ENGINEERING WORKSHOP

(Common to All Branches of Engineering)

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting, electrical house wiring skills, and basic repairs of two-wheeler vehicle.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Identify workshop tools and their operational capabilities.	**Remember**
CO2	Practice on manufacturing of components using workshop trades including fitting, carpentry,foundry, and welding.	**Understand**
CO3	Modal various basic prototypes in fitting trade.	**Apply**
CO4	Apply basic electrical engineering knowledge for House Wiring Practice	**Apply**

SYLLABUS

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
    a. Half – Lap joint
    b. Mortise and Tenon joint
    c. Corner Dovetail joint or Bridlejoint
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 followingfitting exercises.
    a. V-fit
    b. Dovetail fit
    c. Semi-circular fit
    d. Bicycle tire punctureand change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and makethe following connections.
    a. Parallel and series
    b. Two-way switch
    c. Godown 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 jointswith coupling for same diameter and with reducer for different diameters.
9. **Basic repairs of Two-wheeler vehicle** – Demonstration of working of two-wheeler vehicle and its repairs.

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.; AtulPrakashan, 2021-22

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I Year I Semester

23AU02- NSS/NCC/SCOUTS AND GUIDES/COMMUNITY SERVICE

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the importance of discipline, character and service motto.	**Understand**
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques.	**Apply**
CO3	Explore human relationships by analyzing social problems.	**Understand**
CO4	Determine to extend their help for the fellow beings and downtrodden people.	**Apply**
CO5	Develop leadership skills and civic responsibilities.	**Apply**

UNIT I Orientation

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

Activities:

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

UNIT II Nature & CareActivities:

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

UNIT III Community ServiceActivities:

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

v. Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

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

General Guidelines:

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

Evaluation Guidelines:

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

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I Year II Semester

23FE05- DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

(Common to All Branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Solve the differential equations related to various engineering fields (Unit – I&II)	**Apply**
CO2	Apply knowledge of partial differentiation in modelling and solving of Partial differential equations.	**Apply**
CO3	Interpret the physical meaning of different operators such as gradient, curl and divergence.	**Apply**
CO4	Evaluate the work done against a field, circulation and flux using Vector Calculus.	**Apply**

UNIT I Differential equations of first order and first degree

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

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

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

UNIT III Partial Differential Equations

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

UNIT IV Vector differentiation

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

UNIT V Vector integration

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

related problems.

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, PearsonPublishers, 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

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I Year II Semester

23FE06- ENGINEERING CHEMISTRY

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

Course Objectives:

- To enable the students to understand the fundamental concepts of chemistry and to provide themwith the knowledge of industrial problems and finding the solutions.
- To understand quality of water, fuels for various applications, polymers, electrochemistry and batteries.
- To learn the basic concepts of surface chemistry and identify the significance of modern engineeringmaterials.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Identify the troubles due to hardness of water and its maintenance in industrial applications.	**Understand**
CO2	Apply Nernst equation in calculating cell potentials, compare batteries for different applications and outline the principles of corrosion for design and effective maintenance of various devices.	**Understand**
CO3	Outline the importance of polymers and alternate fuels.	**Understand**
CO4	Summarize the suitability of engineering materials like composites, refractories, lubricants, and building materials.	**Understand**
CO5	Understand the concepts of collides, micelles and nanomaterials	**Understand**

UNIT I Water Technology

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

UNIT II Electrochemistry and Applications

Electrodes –electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad),and lithium ion batteries- working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion**,** cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

UNIT III Polymers and Fuel Chemistry

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth

polymerization.

Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC Nylon 6,6 and Bakelite.
Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol rubbers.
Fuels – Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octaneand Cetane number- alternative fuels- propane, methanol, ethanol and bio fuel-bio diesel.

UNIT IV Modern Engineering Materials

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

UNIT V Surface Chemistry and Nanomaterials

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

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

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I Year II Semester

23EE01- BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to All branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Extract electrical variables of AC & DC circuits using fundamental laws.	**Understand**
CO2	Understand the operation of electrical machines and measuring instruments.	**Understand**
CO3	Classify various energy resources, safety measures and interpret electricity bill generation inelectrical systems.	**Understand**

PART A: BASIC ELECTRICAL ENGINEERING

UNIT I DC & AC Circuits

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

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

UNIT II Machines and Measuring Instruments

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

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

UNIT III Energy Resources, Electricity Bill & Safety Measures

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

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

TEXT 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

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 UniversityPress, 2017
4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications,2018, Second Edition.

Web Resources:

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

PART B: BASIC ELECTRONICS ENGINEERING

Course Objectives:

- To teach the fundamentals of semiconductor devices and its applications, principles of digital electronics.

Course Outcomes:

COs	Statements	Blooms Level
CO4	Interpret the characteristics of various semiconductor devices	**Remember**
CO5	Infer the operation of rectifiers, amplifiers.	**Understand**
CO6	Contrast various logic gates, sequential and combinational logic circuits.	**Understand**

UNIT I SEMICONDUCTOR DEVICES

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

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

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

UNIT III DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code,

Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

TEXT 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

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.

End examination pattern:

i) Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35marks each.
ii) In each part, question 1 shall contain 5 compulsory short answer questions for a total of5 marks such that each question carries 1 mark.
iii) In each part, questions from 2 to 4, there shall be either/or type questions of 10 markseach. Student shall answer any one of them.
iv) The questions from 2 to 4 shall be set by covering one unit of the syllabus for eachquestion.

L	T	P	C
3	0	0	3

I Year II Semester

23CS01- INTRODUCTION TO PROGRAMMING

(Common to All branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand basics of computers, concept of algorithms and flowcharts.	**Understand**
CO2	Understand the features of C language.	**Understand**
CO3	Interpret the problem and develop an algorithm to solve it.	**Apply**
CO4	Implement various algorithms using the C programming language.	**Apply**
CO5	Develop skills required for problem-solving and optimizing the code	**Apply**

UNIT I Introduction to Programming and Problem Solving

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

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

UNIT II Control Structures

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

UNIT III Arrays and Strings

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

UNIT IV Pointers & User Defined Data types

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

UNIT V Functions & File Handling

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

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

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-HillEducation, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan,Gilberg, Prasad,CENGAGE, 3rd edition

L	T	P	C
3	0	0	3

I Year II Semester

23ME02- ENGINEERING MECHANICS

(Common to Civil, Mechanical Engineering & Allied branches)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Determine the resultant of coplanar concurrent and non-concurrent force systems	**Apply**
CO2	Apply static equilibrium conditions to determine unknown planar force systems anddetermine the frictional forces for bodies in contact.	**Apply**
CO3	Calculate the centroids, center of gravity and moment of inertia of different geometricalshapes.	**Apply**
CO4	Apply the principles of work-energy and impulse-momentum to solve the problems ofrectilinear and curvilinear motion of a particle.	**Apply**
CO5	Solve the problems involving the translational and rotational motion of rigid bodies.	**Apply**

UNIT I

Introduction to Engineering Mechanics– Introduction, Basic Terminology in mechanics, Laws of mechanics, Characteristics of forces, resolution & composition of forces.

Systems of Forces: Coplanar Concurrent Forces– Coplanar Non-Concurrent Forces, moment of force, applications- Couples and Resultant of Force Systems.

UNIT II

Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Triangle law of forces, polygon law of forces condition of equilibrium, Analysis of plane trusses, Principle of virtual work with simple examples.

Friction: Introduction, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction,limiting friction and impending motion of blocks resting on horizontal and inclined planes.

UNIT III

Centroid: Centroids of simple figures (from basic principles)–Centroids of I, T, C, L Sections.

Centre of Gravity: Centre of gravity of simple bodies (from basic principles).

Area Moments of Inertia: Definition, Moment of inertia of I, T, C, L Sections– Polar Moment ofInertia, Transfer Theorem.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments ofInertia for simple objects.

UNIT IV

Rectilinear and Curvilinear motion of a particle: Introduction to Kinematics and Kinetics, Generalprinciples in dynamics, Rectilinear and curvilinear motions- motion with uniform velocity, uniform acceleration and non-uniform acceleration – D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method (theory only).

UNIT V

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

L	T	P	C
0	0	2	1

I Year II Semester

23FE54- ENGINEERING CHEMISTRY LAB

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

Course Objectives:

- To enable the students to analyze water samples and perform different types of volumetric titrations.
- To provides an overview of preparation of polymers, nanomaterials and analytical techniques.
- To measure the important parameters of fuels, lubricants and composition of cement.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Analyze important parameters of water to check its suitability for drinking purposes andindustrial applications.	**Analyze**
CO2	Acquire practical knowledge related to preparation of Bakelite and nanomaterials.	**Apply**
CO3	Distinguish different types of titrations in volumetric analysis after performing theexperiments listed in the syllabus.	**Apply**
CO4	To estimate the amount of calcium in cement and the strength of acid present in Pb-Acidbattery.	**Apply**
CO5	Improve individual / teamwork skills, communication and report writing skills with ethicalvalues.	**Apply**

List of Experiments:

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

Reference:

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

L	T	P	C
0	0	3	1.5

I Year II Semester

23EE51- ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

(Common to All branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Compute voltage, current and power in an electrical circuit.	**Apply**
CO2	Compute medium resistance using Wheat stone bridge.	**Apply**
CO3	Discover critical field resistance and critical speed of DC shunt generators.	**Apply**
CO4	Estimate reactive power and power factor in electrical loads.	**Understand**
CO5	Plot the characteristics of semiconductor devices.	**Apply**
CO6	Demonstrate the working of various logic gates using ICs.	**Understand**

Activities:

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

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter

6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, FirstEdition
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, ThirdEdition

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 ofelectron 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 gatesusing ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

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

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, PearsonEducation,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,PearsonEducation,2009.

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

L	T	P	C
0	0	3	1.5

I Year II Semester **23CS51- COMPUTER PROGRAMMING LAB**
(Common to All branches of Engineering)

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Read, understand, and trace the execution of programs written in C language.	**Understand**
CO2	Apply the right control structure for solving the problem.	**Apply**
CO3	Develop, Debug and Execute programs to demonstrate the applications of arrays, functions,pointers and files in C.	**Apply**
CO4	Improve individual / teamwork skills, communication and report writing skills with ethicalvalues.	**Apply**

UNIT I

WEEK 1

Objective: Getting familiar with the programming environment on the computer andwriting 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 aseriesof 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:

Tutorial 4: Operators and the precedence and as associativity:

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

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

WEEK 5

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

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

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

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

WEEK 6

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

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

i. Find the factorial of given number using any loop.
ii. Find the given number is a prime or not.
iii. Compute sine and cos series
iv. Checking a number palindrome
v. Construct a pyramid of numbers.

UNIT III

WEEK 7:

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

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7:1D Array manipulation, linear search

i. Find the min and max of a 1-D integer array.
ii. Perform linear search on1D array.
iii. The reverse of a 1D integer array
iv. Find 2's complement of the given binary number.
v. Eliminate duplicate elements in an array.

WEEK 8:

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

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

i. Addition of two matrices
ii. Multiplication two matrices
iii. Sort array elements using bubble sort
iv. Concatenate two strings without built-in functions
v. Reverse a string using built-in and without built-in string functions

UNIT IV

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 array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

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

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'smethod

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functionsthat 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 thedifferences 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() andfwrite()
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.

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

L	T	P	C
0	0	3	1.5

I Year II Semester

23ME52- ENGINEERING MECHANICS LAB

(Mechanical Engineering & allied branches)

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

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Evaluate the coefficient of friction between two different surfaces and between the inclinedplane and the roller	**Apply**
CO2	Verify Law of Polygon of forces and Law of Moment using force polygon and bell cranklever.	**Apply**
CO3	Determine the Centre of gravity and Moment of Inertia of different configurations.	**Apply**
CO4	Apply the equilibrium conditions of a rigid body under the action of different force systems	**Apply**

Students have to perform any 10 of the following Experiments:

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 equilibriumusing 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 coplanarnon-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 tothe 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.

References:

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

L	T	P	C
0	0	1	0.5

I Year II Semester

23AU01- HEALTH AND WELLNESS, YOGA AND SPORTS

(Common to All branches of Engineering)

Course Objectives:

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

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

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

UNIT I

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

Activities:

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

UNIT II

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

Activities:

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

UNIT III

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

Activities:

i. Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
ii. Practicing general and specific warm up, aerobics
iii. Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping andrunning.

REFERENCE BOOKS:

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

General Guidelines:

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

Evaluation Guidelines:

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

B.Tech II Year I Semester	23FE09 - NUMERICAL METHODS AND TRANSFORM TECHNIQUES	L	T	P	C
		3	0	0	3

Course Objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals	**Apply**
CO2	Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations	**Apply**
CO3	Apply the Laplace transform for solving differential equations	**Apply**
CO4	Find or compute the Fourier series of periodic signals	**Apply**
CO5	Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms	**Apply**

UNIT - I: Iterative Methods:

Introduction - Solutions of algebraic and transcendental equations: Bisection method - Secant method - Method of false position - Iteration method - Newton-Raphson method (Simultaneous Equations)

Interpolation: Newton's forward and backward formulae for interpolation - Interpolation with unequal intervals - Lagrange's interpolation formula

UNIT - II: Numerical integration, Solution of ordinary differential equations with initial conditions:

Trapezoidal rule- Simpson's I/3rd and 3/8th rule- Solution of initial value problems by Taylor's series- Picard's method of successive approximations- Euler's method -Runge- Kutta method (second and fourth order) - Milne's Predictor and Corrector Method.

UNIT-III: Laplace Transforms:

Definition of Laplace transform - Laplace transforms of standard functions - Properties of Laplace Transforms - Shifting Theorems-Transforms of derivatives and integrals - Unit step function - Dirac's delta function - Inverse Laplace transforms - Convolution theorem (without proof).

Applications: Solving ordinary differential equations (initial value problems) and Integro differential equations using Laplace transforms.

UNIT - IV: Fourier series:

Introduction- Periodic functions - Fourier series of periodic function -Dirichlet's conditions- Even and odd functions -Change of interval- Half-range sine and cosine series.

UNIT - V: Fourier Transforms:

Fourier integral theorem (without proof) - Fourier sine and cosine integrals - Infinite Fourier transforms - Sine and cosine transforms - Properties- Inverse transforms - Convolution theorem (without proof) - Finite Fourier transforms.

TEXT BOOKS:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **B. V. Ramana,** Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

REFERENCE BOOKS:

1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
2. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
3. **M. K. Jain, S.R.K. Iyengar and R.K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. **Lawrence Turyn**, Advanced Engineering Mathematics, CRC Press

B.Tech II Year I Semester	23HS01 - UHV-2 UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT	L	T	P	C
		2	1	0	3

Course Objectives:

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

Course Outcomes:

COs	Statements	Blooms Level
CO1	Describe the terms like Natural Acceptance, Happiness and Prosperity	**Understand**
CO2	Identify one's self, and one's surroundings (family, society nature)	**Understand**
CO3	Relate human values with human relationship and human society	**Understand**
CO4	Illustrate the need for universal human values and harmonious existence	**Understand**
CO5	Develop as socially and ecologically responsible engineers	**Apply**

Course Topics The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I

Introduction to Value Education (6 lectures and 3 tutorials for practice session)
Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself
Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

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

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

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order
Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance
Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self

PS6 Exploring Harmony of self with the body
Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal
Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence
Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a.The Textbook

R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. **The Teacher's Manual**

R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

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

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions. While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements. In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up ”ordinary” situations rather than” extra-ordinary” situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

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

Online Resources:

- https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
- https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
- https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
- https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
- https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
- 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
- https://fdp-si.aicte india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
- https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385 https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

B.Tech II Year I Semester	23AE01 – INTRODUCTION TO AEROSPACE ENGINEERING	L	T	P	C
		2	0	0	2

Course Objective:

- To learn the components of airplane and different types of flight vehicles, the basic aspects of aerodynamics and airfoils.
- To learn the elements of propulsive systems, function of structural components in wing and fundamental aspects of flight vehicle in space.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Describe functions of various external and internal components of an airplane	**Understand**
CO2	Classify the various forces and moments acting on an airfoil	**Understand**
CO3	Differentiate the working principles of various aircraft engines systems	**Understand**
CO4	Formulate the basic aspects of space flight	**Apply**

UNIT - I

BASIC ASPECTS: History-Early Planes, Components of Airplane and Their Functions, Types of Flight Vehicles, Classifications, Standard Atmosphere, Altitude, Hydrostatic Equation, Geopotential and Geometric Altitudes

UNIT -II

BASIC AERODYNAMICS: Introduction – Airfoils - Airfoil Nomenclature, Classifications of NACA Airfoils, Wing Geometry, Aerodynamic Forces, Lift, Drag and Moment Coefficients, Co-Efficient of Pressure, Centre of Pressure, Aerodynamics Centre, Pressure Distribution Over Aerofoil, Types of Drag.

UNIT - III

PROPULSION: Introduction, Propeller, Reciprocating Engine, Jet Propulsion-The Thrust Equation, Elements of Turbojet Engine-Turbofan Engine-Rocket Engine, Rocket Propellants-Liquid Propellants, Solid Propellants, Rocket Staging

UNIT - IV

FLIGHT VEHICLE STRUCTURES: Introduction, Fuselage-Monocoque, Semi-Monocoque Structures, Components of Wing-Spars, Ribs, Longerons, Stringers, Bulkheads, Aircraft Materials-Metallic and Non-Metallic Materials, Use of Aluminium Alloy, Titanium, Stainless Steel and Composite Materials

UNIT – V

SPACE FLIGHT: Introduction, Orbit Equation, Basic Aspects of Space Vehicle Trajectories, Kepler's Laws, Earth and Planetary Entry, Space Explorations- Space Vehicles and Its types, Reusable Space Vehicles, Space Shuttle, Satellites, Types of Satellites and Their Functions.

TEXT BOOK:

1. Anderson. J. D, Mary L. Bowden, Introduction to Flight, Ninth Edition, McGraw-Hill Education, 2021.

REFERENCE BOOKS:

1. E. Rathakrishnan., Introduction to Aerospace Engineering (Basic Principles of Flight), Wiley, First Edition, 2021
2. Houghton. E. L., Carpenter P.W., Aerodynamics for Engineering Students, Seventh Edition, Butterworth-Heinemann, 2017.
3. Kermode. A. C, Mechanics of Flight, Eleventh Edition, Pearson Education, 2007.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/101/101/101101079/
2. https://ocw.tudelft.nl/courses/introduction-aerospace-engineering/

B.Tech II Year I Semester **23AE02 – ENGINEERING FLUID MECHANICS**

L	T	P	C
3	0	0	3

Course Objectives:

- To demonstrate the properties of fluids and behavior of fluids under static conditions.
- To teach differential relations for fluid flows, features of flow though pipes.
- To understand the working of Hydraulic turbines and Hydraulic pumps.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply fluid static principles on objects submerged in fluids	**Apply**
CO2	Apply the conservation laws to solve elementary fluid flow problems	**Apply**
CO3	Apply the fluid flow principles to simple pipe network for fluid transportation	**Apply**
CO4	Determine the performance of various hydraulic turbines and pumps	**Apply**

UNIT - I

INTRODUCTION: Fluids and Continuum, Classification of Fluids, Properties of Fluid – Pressure, Temperature, Density, Specific Weight, Specific Gravity, Viscosity-Newton's Law of Viscosity, Compressibility, Surface Tension, Capillarity, Vapour Pressure

Fluid Statics: Pressure Acting at a Point in a Static Fluid-Pascal's Law, Basic Equation of Fluid Statics-Hydrostatic Pressure Distribution, Hydrostatic Forces on Submerged Plane Surfaces, Manometers, Buoyancy and Stability, Hydostatic pressure distribution in earth's atmosphere

UNIT - II

ANALYSIS OF FLUID FLOW: Eulerian and Lagrangian Approaches, Velocity Field, Flow Patterns- Pathline, Streamline, Streakline, Timeline, Stream Tube.

DIFFERENTIAL RELATIONS FOR FLUID FLOW: Acceleration Field of a Fluid, Differential Equation of Mass Conservation, Differential Equation of Linear Momentum, Euler's Equation, Stream Function, Rotationality and Irrotationality, Vorticity, Velocity Potential, Potential Flow, Bernoulli Equation and its Applications- Orifice Tank, Venturi Meter, Pitot-static tube, Nozzle, Water siphon

UNIT - III

FLOW THROUGH PIPES: Introduction, Reynolds Experiment, Head Loss, Darcy-Wiesbach Equation, Hydraulic Gradient and Total Energy Lines, Laminar Fully Developed Pipe Flow- Hagen Poiseuille Law, Moody Chart, Pipes in Series, Equivalent Pipe, Pipes in Parallel, Minor Losses, Hydraulic Diameter.

DIMENSIONAL ANALYSIS AND SIMILARITY: Introduction, Principle of Dimensional Homogeneity, Buckingham's Pi Theorem, Dimensionless Groups, Similarity.

UNIT IV

HYDRAULIC TURBINES: Introduction, Classification of Turbines- Impulse and Reaction Turbines, Pelton Turbine, Francis Turbine and Kaplan Turbine-Working Principle, Velocity Triangles, Work Done and Efficiency, Draft Tube, Surge Tank, Unit and Specific Quantities

UNIT V

CENTRIFUGAL PUMPS: Classification, Working Principle, Velocity Triangles, Work Done, Head and Efficiencies, Losses, Specific Speed, Pumps in Series and Parallel

RECIPROCATING PUMPS: Classification, Working Principle, performance calculation-Equation for discharge, Co-Efficient of Discharge and Slip, Equation for power input, Indicator Diagram.

TEXT BOOK

1. Rathakrishnan. E, Fluid Mechanics an Introduction, Fourth Edition, Prentice Hall of India, 2021.
2. Balachandran P, Engineering Fluid Mechanics, Prentice Hall of India, 2012.

REFERENCES

1. White. F.M, Fluid Mechanics, Seventh Edition, McGraw-Hill Education 2011
2. Fox. R.W, Mcdonald, A.J, Introduction of Fluid Mechanics, Fifth Edition, John Wiely, 1999.
3. Douglas. J.F, Gesiorek. J.M., Swaffield. J, A., Fluid Mechanics, Fourth Edition, Pearson Education, 2002.
4. Shames. I.H, Mechanics of Fluids, Third Edition, McGraw-Hill, 1992.

Online Learning Resources:

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

B.Tech II Year I Semester **23AE03 – ENGINEERING THERMODYNAMICS**

L	T	P	C
3	0	0	3

Course Objectives:

- To learn the basic concepts of energy conversions, laws of thermodynamics, concept of entropy and properties of pure substances.
- To familiarize basic aspects of gas power cycles and internal combustion engines

Course Outcomes:

COs	Statements	Blooms Level
CO1	Describe the thermodynamic properties of various systems	**Understand**
ACO2	Apply the laws of thermodynamics to analyze various thermal systems.	**Apply**
CO3	Understand the properties of pure substances	**Understand**
CO4	Formulate performance parameters of various gas power cycles	**Apply**
CO5	Describe the working of Internal Combustion Engines.	**Understand**

UNIT - I

Basic Concepts: Introduction, Macroscopic and Microscopic Viewpoints, Thermodynamic System, Types of systems, Properties of a System, Continuum Thermodynamic Equilibrium, Quasi Static Process, Temperature-Temperature Scales, Zeroth Law of Thermodynamics, Energy, Forms of Energy, Heat, Work, Different forms of Work, Path and Point Functions.

UNIT - II

First Law of Thermodynamics: Introduction, Joule's Experiment, First Law Analysis of Closed System, Internal Energy, Conservation of Mass, Conservation of Energy, Specific Heat, Enthalpy, Principle-Flow Work.

First Law Analysis of Control Volume: The Steady Flow Process-Steady Flow Energy Equation, Applications of Steady Flow Energy Equation, Steady Flow Devices, Energy Analysis of Steady Flow Devices.

UNIT - III

Second Law of Thermodynamics: Introduction, Thermal Energy Reservoirs, Heat Engines, Refrigerators, Heat Pumps. Kelvin-Planck & Clausius Statements and their Equivalence/Corollaries. Reversible and Irreversible Processes, Carnot Cycle, Carnot Principles, Absolute Thermodynamic Temperature Scale, The Carnot Heat Engine, Heat Pump and Refrigerator.

Entropy: Introduction Entropy- Clausius Inequality, Principle of Increase of Entropy, Tds-Relations, Entropy Change for incompressible and compressible substances, Isentropic Relations for Ideal Gases, Maxwell Relation, Third Law of Thermodynamics.

UNIT – IV

Properties of Pure Substances: Introduction, Phases of Pure Substance, Phase Change Processes- Saturated Liquid, Saturated Vapor, Super-Heated Vapor, Property Diagrams- Pressure-Volume, Pressure-Temperature, Temperature-Entropy, Enthalpy-Entropy, Pressure-Volume-Temperature Surface, Dryness Fraction-Saturated Liquid Vapor Mixture.

Gas Power Cycles: Introduction, Analysis of Power Cycles, The Carnot cycle, Air-standard Assumptions, Otto, Diesel, Dual, and Brayton Cycles.

UNIT – V

Internal Combustion (IC) Engines: Classification of IC Engines, Components of IC engines, working Principles of 4-Stroke and 2-Storke Engines, Working Principles of Spark Ignition (SI) Engine, Compression Ignition (CI) Engine, Valve and Port Timing Diagrams, Air-fuel Mixture, Carburation, Performance Analysis of IC engines.

TEXT BOOKS:

1. Rathakrishnan. E, Fundamentals of Engineering Thermodynamics, Second Edition, Prentice Hall of India, 2010.
2. Mahesh M Rathore, Thermal Engineering, Sixteenth Reprint, McGraw Hill Education India Private Limited, 2017

REFERENCE BOOKS:

1. Nag. P.K, Engineering Thermodynamics, Sixth Edition, McGraw Hill Education India Private Limited, 2017.
2. Yunus A Cengel, Michale A. Boles, and Mehmet Konoglu, Thermodynamics: An Engineering Approach, Ninth Edition in SI units, McGraw Hill Education India Private Limited, 2019.
3. Sonntag. R. E, Borgnakke. C Van, Fundamentals of Thermodynamics, Tenth Edition, John Wiley & Sons publications Inc, 2019.

Online Learning Resources:

- https://www.edx.org/learn/thermodynamics
- https://archive.nptel.ac.in/courses/112/106/112106310
- https://www.coursera.org/learn/thermodynamics-intro

B.Tech II Year I Semester	23MC01 – ENVIRONMENTAL SCIENCE	L	T	P	C
		2	0	0	-

Course Objectives:

The objective of this course is to understand Environmental issues like natural resource depletion, pollution, interaction between human and ecosystems and their role in the food web in the natural world, importance of global biodiversity and significance of environmental law in India.

Course Outcomes:

COs	Statements	Blooms Level
CO1	The necessity of resources, their exploitation and sustainable management	Understand
CO2	The interactions of human and ecosystems and their role in the food web in the natural world and the global biodiversity, threats to biodiversity and its conservation	Understand
CO3	Environmental problems like pollution, disasters and possible solutions.	Remember
CO4	The importance of environmental decision making in organizations through understanding the environmental law and environmental audits	Remember
CO5	Environmental issues like over population, human health etc related to local, regional and global levels	Understand

UNIT – I

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

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

UNIT – II

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

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

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity:

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

UNIT – III

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

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

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

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – 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 Carbon credits & Mission LiFE - Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

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

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

TEXT BOOKS:

1. Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses,Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

REFERENCE BOOKS:

1. KVSG Murali Krishna, The Book of Environmental Studies, 2/e, VGS Publishers, 2011.
2. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
3. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
4. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
5. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
6. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
7. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-

B.Tech II Year I Semester	23AE51 - ENGINEERING FLUID MECHANICS LAB	L	T	P	C
		0	0	3	1.5

Course Objective:

- To learn about the insights of calculating the discharge in various flow measuring devices.
- To work on performance parameters of hydraulic machines.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply the principles of Fluid mechanics in discharge measuring devices used in pipes, channels and tanks	**Apply**
CO2	Analyze the performance of various hydraulic machines	**Analyze**

LIST OF EXPERIMENTS

(Any of the 10 Experiments are required to be conducted)

1. Verification of Bernoulli's Theorem
2. Calibration of Venturi meter
3. Calibration of Orifice meter.
4. Determination of friction factor for a given pipeline
5. Determination of loss of head due to sudden contraction in a pipeline
6. Determine Co-Efficient of Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Kaplan Turbine.
9. Performance Test on Single Stage Centrifugal Pump.
10. Performance Test on Reciprocating Pump.
11. Determination of co-efficient discharge using Turbine flow meter.
12. Flow visualization using Reynolds experiment.
13. Flow Visualization study using Water Flow Channel

REFERENCE: Lab Manual

B.Tech II Year I Semester	23AE52 - APPLIED THERMODYNMICS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To familiarize the working of various Internal Combustion Engines and to evaluate the performance parameters of Internal Combustion Engines.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Demonstrate the working of various IC Engine systems and components.	**Understand**
CO2	Analyze the performance characteristics of Internal Combustion Engines	**Analyze**

LIST OF EXPERIMENTS

(Any of the 10 Experiments are required to be conducted)

1. I.C. Engine Valve and Port Timing Diagram.
2. Determination of calorific value of fuel using bomb calorimeter.
3. Determination of viscosity of fuel by using viscometer.
4. Performance Test on single cylinder 4-Stroke Diesel engine by using Mechanical Dynamometer.
5. Evaluation of performance parameters of twin cylinder 4-stroke Diesel engine.
6. Determination of performance characteristics of 2-Stroke Petrol Engine.
7. Evaluation of engine friction power by conducting Morse test on Multi cylinder 4-Stroke Diesel Engine.
8. Preparation of Heat Balance Sheet for 4 stroke Diesel engine
9. Performance Test on Reciprocating Air–Compressor.
10. Demonstration of automobile working components.
11. Measurement of exhaust emissions and smoke of I.C Engines.
12. Solar parabolic concentrator apparatus

References: Lab manual.

B.Tech II Year I Semester	23CS57 - PYTHON PROGRAMMING LAB	L	T	P	C
		0	0	2	1

Course Objectives:

1. **Fundamental Understanding:** Develop a solid foundation in Python programming, covering essential syntax, semantics, and constructs.
2. **Data Manipulation:** Equip students with skills to handle and manipulate data using Python libraries like Pandas and NumPy.
3. **Problem-Solving:** Enhance problem-solving abilities by implementing various algorithms and data structures in Python.
4. **Software Development:** Foster software development skills, including version control, package management, and project documentation.
5. **Advanced Techniques:** Introduce advanced Python topics such as web scraping, API interaction, and database management.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Solve the different methods for linear, non-linear and differential equations	**Evaluate**
CO2	Learn the PYTHON Programming language	**Remember**
CO3	Familiar with the strings and matrices in PYTHON	**Remember**
CO4	Write the Program scripts and functions in PYTHON to solve the methods	**Create**
CO5	Evaluate different methods of numerical solutions	**Evaluate**

Experiment 1: Introduction to Python

- Objective: Install Python and set up the development environment.
- Tasks:
  - Install Python and an IDE (e.g., PyCharm, VSCode, or Jupyter Notebook).
  - Write and run a simple "Hello, World!" program.
  - Understand and demonstrate basic Python syntax and semantics.

Experiment 2: Basic Python Programming

- Objective: Learn basic programming constructs in Python.
- Tasks:
  - Create programs using variables, data types, and operators.
  - Implement basic input and output functions.
  - Write programs using control structures (if statements, for loops, while loops).

Experiment 3: Functions and Modules

- Objective: Understand functions and module usage in Python.
- Tasks:
  - Define and call functions with different types of arguments and return values.

- Explore and use built-in Python modules.
- Write a script that imports and utilizes at least two different standard library modules.

Experiment 4: Lists and Tuples

- Objective:Work with Python lists and tuples.
- Tasks:
  - Create, modify, and iterate over lists and tuples.
  - Perform list comprehensions to create new lists.
  - Demonstrate the immutability of tuples.

Experiment 5: Dictionaries and Sets

- Objective: Explore dictionaries and sets in Python.
- Tasks:
  - Create and manipulate dictionaries.
  - Use dictionary comprehension.
  - Create and perform operations on sets.

Experiment 6: Strings and File I/O

- Objective: Manipulate strings and perform file I/O operations.
- Tasks:
  - Demonstrate various string methods.
  - Write programs to read from and write to text files.
  - Work with different file formats, including CSV and JSON.

Experiment 7: Error Handling and Exceptions

- Objective: Implement error handling in Python programs.
- Tasks:
  - Write programs using try, except, else, and finally blocks.
  - Handle specific exceptions.
  - Create and raise custom exceptions.

Experiment 8:Object-Oriented Programming (OOP)

- Objective: Understand and implement OOP concepts in Python.
- Tasks:
  - Define classes and create objects.
  - Demonstrate inheritance and polymorphism.
  - Use class and instance variables in programs.

Experiment 9:Libraries and Packages

- Objective: Utilize third-party libraries and create Python packages.
- Tasks:
  - Install and use libraries like NumPy and Pandas.
  - Create a simple Python package and distribute it.
  - Work with virtual environments to manage dependencies.

Experiment 10: Working with Data

-Objective: Perform data manipulation and visualization.

- Tasks:
  - Use Pandas to load, manipulate, and analyze datasets.
  - Create visualizations using Matplotlib and Seaborn.
  - Conduct basic data analysis tasks and summarize findings.

Experiment 11: Web Scraping and APIs

- Objective: Extract data from the web and interact with APIs.
- Tasks:
  - Access and parse data from RESTful APIs.
  - Process and analyze JSON data from APIs.

Experiment 12: Databases

- **Objective:** Work with databases in Python.
- **Tasks:**
  - Connect to a database using SQLite and SQLAlchemy.
  - Perform CRUD operations on the database.
  - Write queries to manage and retrieve data.

Online Learning Sources:

- https://www.udemy.com/course/python-the-complete-python-developer-course/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaign=BG-Python_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=_._ag_1220458320107116_._ad__._kw_Python+language_._de_c_._dm__._pl__._ti_kwd-76278984197882%3Aloc-90_._li_116074_._pd__._&couponCode=IND21PM
- https://www.w3schools.com/python/python_intro.asp
- https://www.youtube.com/watch?v=eWRfhZUzrAc
- https://onlinecourses.nptel.ac.in/noc20_cs83/preview
- https://www.edx.org/learn/python
- Virtual Labs - https://python-iitk.vlabs.ac.in/
- Virtual Labs - https://virtual-labs.github.io/exp-arithmetic-operations-iitk/
- Virtual Labs - https://cse02-iiith.vlabs.ac.in/ https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manual.pdf

B.Tech II Year I Semester	23AES1 - COMPUTER AIDED DESIGN LAB	L	T	P	C
		0	1	2	2

Course Objective:

- The course aims to teach developing and drawing Machine components using AutoCAD.
- To teach the students fundamentals of AutoCAD.
- To learn 2-D, Isometric and 3-D Component Designs.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Draw simple objects using functional tools in AutoCAD	**Understand**
CO2	Create solid models of machine and Simple Aircraft components.	**Apply**
CO3	Translate 3D components into 2D drawings.	**Apply**

List of Experiments (10 Experiments)

- **Introduction to AUTOCAD**
- **BASIC AUTOCAD COMMANDS**
  1. Basic drawing commands (line, circle, arc, ellipse, polygon, and rectangle).
  2. Edit commands (copy, move, erase, zoom).
  3. Array commands (polar array, rectangular array, P-edit, divide, pline, offset).
  4. Hatching &line commands (hatching with different angles& different types of lines).
  5. Mirror & trim commands (mirror an object, trim, extend a line, chamfer &fillet, explode).
  6. Dimensioning & text commands (linear, angular, radius, diameter& text).
- **2-D DRAWINGS OF MACHINE COMPONENTS**
- **ISOMETRIC DRAWINGS**
- **3-D DESIGNS OF SIMPLE AIRCRAFT COMPONENTS**
  1. Propeller Blade Hub
  2. Structural components of Wing
  3. Propulsive components like Nozzles, Turbine, combustion chamber, etc.
  4. Engine Casing
  5. Basic Aircraft model
  6. Aircraft Components Like Nose, Wing, Fuselage Tail parts, etc.

B.Tech II Year II Semester	23HS03 - INDUSTRIAL MANAGEMENT	L	T	P	C
		2	0	0	2

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.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Learn about how to design the optimal layout	Remember
CO2	Demonstrate work study methods	Apply
CO3	Explain Quality Control techniques	Understand
CO4	Discuss the financial management aspects and	Understand
CO5	Understand thehuman resource management methods.	Understand

UNIT– I

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

PLANT LAYOUT: 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, plant maintenance, preventive and break down maintenance.

UNIT–II

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

TOTALQUALITYMANAGEMENT: zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma–definition, basic concepts

UNIT– IV

FINANCIAL MANAGEMENT: Scope and nature of financial management, Sources of finance, Ratio analysis, Management of working capital, estimation of working capital requirements, stock

management, Cost accounting and control, 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: 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.

TEXT BOOKS:

1.O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd, 2018.

2.Mart and Telsang, Industrial Engineering and Production Management, S.Chand &Company Ltd. New Delhi, 2006.

REFERENCE BOOKS:

1. Bhattacharya DK, Industrial Management, S.Chand, publishers, 2010.
2. J.G Monks, Operations Management,3/e, McGraw Hill Publishers1987.
3. T.R. Banga, S.C.Sharma, N. K. Agarwal, Industrial Engineering and Management Science, Khanna Publishers, 2008.
4. Koontz' Donnell, Principles of Management, 4/e, McGraw Hill Publishers, 1968.
5. R.C. Gupta, Statistical Quality Control, Khanna Publishers, 1998.
6. NVS Raju, Industrial Engineering and Management,1/e, Cengage India Private Limited, 2013.

Online Learning Sources:

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

B.Tech II Year II Semester

23FE13 - COMPLEX VARIABLES, PROBABILITY AND STATISTICS

L	T	P	C
3	0	0	3

Course Objectives:

- To familiarize the complex variables.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic.	Apply
CO2	Make use of Cauchy residue theorem to evaluate certain integrals.	Apply
CO3	Infer the statistical inferential methods based on small and large sample tests .	Analyze
CO4	Find the differentiation and integration of complex functions used in engineering problems.	Apply
CO5	Design the components of a classical hypothesis test.	Analyze

UNIT— I: Functions of a complex variable and Complex integration:

Introduction—Continuity —Differentiability—Analyticity —Cauchy-Riernann equations in Cartesian and polar coordinates—Harmonic and conjugate harmonic functions— Milne—Thompson method.

Complex integration: Line integral —Cauchy's integral theorem —Cauchy's integral formula—Generalized integral formula (all without proofs) and problems on above theorems.

UNIT — II: Series expansions and Residue Theorem:

Radius of convergence — Expansion in Taylor's series, Maclaurin's series and Laurent series.

Types of Singularities: Isolated — Essential —Pole of order m— Residues — Residue theorem (without proof) —Evaluation of real integral of tilt types

$\int_{-\infty}^{\infty} f(x)dx$ and $\int_{c}^{c+2\pi} f(\sin\theta,\cos\theta)d\theta$

UNIT—III: Probability and Distributions:

Review of probability and Baye's theorem — Random variables — Discrete and Continuous random variables — Distribution functions — Probability mass function, Probability density function and Cumulative distribution functions — Mathematical Expectation and Variance — Binomial, Poisson, Uniform and Normal distributions.

UNIT—IV: Sampling Theory:

Introduction — Population and Samples — Sampling distribution of Means and Variance (definition only)—Central limit theorem (without proof)—Representation of the normal

χ^2

theory distributions— Introduction to t, and F-distributions- point and interval estimations — maximum error of estimate.

UNIT—V: Tests of Hypothesis:

Introduction - Hypothesis - Null and Alternative Hypothesis - Type I and Type II errors - Level of significance - One tail and two-tail tests - Tests concerning one mean and two means (Large and Small samples)-Tests on proportions

TEXT BOOKS:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **Miller and Freund's,** Probability and Statistics for Engineers,7/e, Pearson, 2008.

REFERENCE ROOKS:

1. **J. W. Brown and R. V. Churchil**l, Complex Variables and Applications, 9th edition, Mc-Graw Hill, 2013.
2. **S. C. Gupta and V.K. Kapoor,** Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. **Jay 1. Devore,** Probability and Statistics for Engineering and the Sciences, 9th Edition, Cengage.
4. **Shron L. Myers, Keying Ye, Ronald E Walpole,** Probability and Statistics for Engineers and the Scientists, 8th Edition. Pearson 2007.
5. **Sheldon M. Ross,** Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011.

Online Learning Sources:

https://biet.ac.in/pdfs/PROBABILITY%20AND%20STATISTICS%20&%20CO

https://archive.nptel.ac.in/courses/111/103/111103070/MPLEX%20VARIABLES.pdf

https://archive.nptel.ac.in/courses/111/105/111105090/

http://acl.digimat.in/nptel/courses/video/111102160/L23.html

https://onlinecourses.nptel.ac.in/noc21_ma57/preview

L	T	P	C

B.Tech II Year II Semester	23AE04 - MATERIALS AND MANUFACTURING TECHNOLOGY	3	0	0	3

Course Objectives:

- The objectives of this course are to acquire knowledge on structure of metals and alloys, understand the concept of alloys.
- To learn equilibrium diagrams and to learn primary manufacturing processes, working of basic machines and various operations to be performed.
- Teach conventional and unconventional machining processes.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the properties of the metals and alloys based on structures.	**Understand**
CO2	Classify, construct and analyze equilibrium diagrams, various ferrous, non-ferrous metals and alloys.	**Understand**
CO3	Acquire knowledge of the basic aspects of casting process.	**Understand**
CO4	Know the various basic concepts of welding process, metal forming process and sheet metal operations in the manufacturing of products.	**Understand**
CO5	Know different conventional and unconventional machining processes while manufacturing a product	**Understand**

UNIT – I

STRUCTURE OF METALS: Crystal Structures-Body centered cubic, Face cantered cubic, closed packed hexagonal, Mechanism of grain and grain boundaries, Effect of grain boundaries on the properties of metal / alloys, Determination of grain size. Solid solutions-Interstitial Solid Solution and Substitution Solid Solution, Hume Rothery rules.

UNIT – II

EQUILIBRIUM DIAGRAMS AND TRANSFORMATIONS: Classification of equilibrium diagrams- isomorphous, eutectic, partial eutectic equilibrium diagrams. Lever rule, Study of Cu-Ni and Iron-Iron carbide equilibrium diagram.

STEEL: Classification of steels, structure, properties and applications of plain carbon steel, low carbon steel, medium carbon steel and high carbon steel.

CAST IRONS: structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, spheroidal graphite cast iron.

NON-FERROUS METALS AND ALLOYS: structure, properties and applications of copper and its alloys, Aluminium and its alloys.

UNIT – III

INTRODUCTION TO MANUFACTURING AND CASTING: Classification of Manufacturing Processes; Steps Involved in Making a Casting- Advantages and Its Applications, Types of Patterns- Pattern Allowances, Principles of Gating, Gating Ratio, Types of Raisers, Special Casting Processes – Centrifugal – Die - Investment – Continuous.

UNIT - IV

WELDING: Classification of Welding Process- Types of Weld- Welded Joints, Principle and Applications- Gas Welding- Arc Welding- Friction Welding, Soldering and Brazing.

METAL FORMING PROCESSES: Types of Rolling Mills and Products; Principles of Forging - Types of Forging-Smith Forging, Drop Forging

EXTRUSION OF METALS: Hot Extrusion and Cold Extrusion –Forward Extrusion and Backward Extrusion, Impact Extrusion, Hydrostatic Extrusion.

UNIT - V

MACHINING PROCESSES: Tool Geometry; Cutting Tool & Tool Wear- Cutting Materials; Cutting Fluids; Introduction and Working Principle of Lathe and Operations

SHAPING, PLANNING, MILLING AND DRILLING MACHINES: Principles of Working, Principle Parts, Specifications, Classification, Comparison and Operations Performed.

INTRODUCTION TO UNCONVENTIONAL MACHINING PROCESSES: Classification of Unconventional Machining Processes. Abrasive Jet Machining, Ultrasonic Machining, Laser Beam Machining

TEXT BOOKS:

1. V.D.Kotgire, S.V.Kotgire, Material Science and Metallurgy, Everest Publishing House, 42nd Edition, 2018.
2. Rao. P. N, Manufacturing Technology, Volume 1 and 2 Tata McGraw-Hill, 2018.

REFERENCE BOOKS:

1. Ghosh. A, Malik. A. K, Manufacturing Science, Second Edition, East West Publisher, 2010.
2. Kalpakjain. S, Schmid. S. R, Manufacturing Processes for Engineering Materials, 6th Edition, Pearson Education, 2017
3. Richard A.Flinn, Paul K.Trojan, Engineering Materials and Their Applications, Jaico Publishing House, 4thEdition, 1999.
4. William and callister, Materials Science and engineering, Wiley India private Ltd., 2011.

L	T	P	C

B.Tech II Year II Semester	23AE05 - SOLID MECHANICS	3	0	0	3

Course Objectives:

- To learn the basic concepts of stress, strain and relations based on linear elasticity,
- Students can analyze beams and draw shear force and bending moment diagrams
- To learn theory of simple bending, Shear and torsion.
- Understand the principal stresses and shear stress distribution.
- Design and analysis of components subjected to deformation and internal pressure.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Describe the concept of stress and strain to analyze and design structural members and machine parts under various loading conditions.	**Understand**
CO2	Evaluate stress, shear force, bending moment, under different loading conditions.	**Apply**
CO3	Analyze Bending and torsional stresses of different components.	**Apply**
CO4	Understand shear stress distributions over different cross sections and concept of Principle Stresses.	**Understand**
CO5	Model and analyze the behavior of basic structural members subjected to deflection and internal pressure.	**Analyze**

UNIT- I

SIMPLE STRESSES AND STRAINS: Stresses and Strains Due to Axial Force, Hooke's Law, Factor of Safety, Stepped Bars – Uniformly Varying Sections - Stresses in Composite Bars Due to Axial Force and Temperature - Strain Energy Due to Axial Force, Stresses Due to Sudden Loads and Impact. Lateral Strain: Poisson's Ratio - Change in Volume – Shear Stress - Shear Strain - Relationship Between Elastic Constants

UNIT – II

SHEAR FORCE AND BENDING MOMENT: Relationship Between Loading - Shear Force and Bending Moment - Shear Force and Bending Moment Diagrams for Cantilever, Simply Supported and Overhanging Beams Subjected to Concentrated Loads and Uniformly Distributed Loads Only - Maximum Bending Moment and Point of Contra Flexure.

UNIT - III

STRESSES IN BEAMS: THEORY OF SIMPLE BENDING: - Introduction-Pure Bending-Theory of Simple Bending with Assumptions - Derivation of The Bending Equation-Bending Stresses in Symmetric Sections – Section Modulus - Calculation of Normal Stresses Due to Flexure Application.

TORSION: Theory of Torsion and Assumptions - Derivation of the Torsion Equation, Polar Modulus, Power Transmitted by a Shaft, Stresses in Solid and Hollow Circular Shafts

UNIT – IV

SHEAR STRESSES: Introduction, Derivation of Shear Stress Distribution Formula – Shear Stress Distribution Across Various Beam Cross Sections Like Rectangular, Circular, Triangular, I and T Sections.

PRINCIPAL STRESSES: State of Stress at a Point-Principal Plane-Principal Stresses- Normal, Tangential and Resultant Stresses on Inclined Planes-Member Subjected to Direct Stress in One Plane, Two Mutually Perpendicular Planes- Two Mutually Perpendicular Planes with Simple Shear, Graphical Method (Mohr's Circle Method).

UNIT – V

DEFLECTION OF BEAMS: Deflection and Slope of Beams Subjected to Point Load and Uniformly Distributed Load- Differential Equation of Elastic Line – Double integration and Macaulay's Methods -Deflection of Statically Determinate Beams-Simply Supported Beam, Cantilever Beam, Overhang Beam with Point Load and Uniformly Distributed Load.

Thin, Thick Shells: Introduction- Thin Cylindrical Vessel Subjected to Internal Pressure-Stresses Due to Internal Pressure- Hoop and Longitudinal Stresses -Efficiency of Joint- Stresses in a Thick Cylindrical Shell-Lame's Equations.

TEXT BOOKS:

1. Ramamrutham. S, Narayanan R, Strength of Materials, Dhanpat Rai & Sons, 2017.
2. B.C. Punmia, Strength of materials,10/e, Lakshmi publications Pvt. Ltd, New Delhi, 2018.

REFERENCE BOOKS:

1. Popov. E. P, Mechanics of Materials, Prentice Hall Inc, 1976.
2. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.
3. Andrew. P, Singer F.L., Strength of Materials, Harper and Row Publishers, New York, 1987.
4. Gambhir. M. L, Fundamentals of Solid Mechanics, PHI Learning, 2009.

Online Learning Resources:

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

B.Tech II Year II Semester	23AE05 - AERODYNAMICS	L	T	P	C
		3	0	0	3

Course Objective:

- To learn the theoretical methods to solve the potential flow problems
- To familiarize potential flow theory to solve for airfoil characteristics
- To familiarize the finite wing theory and properties of viscous flows and boundary layer development over flat plate

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply Laplace equation for obtaining 2D and axisymmetric solutions	**Apply**
CO2	Apply conformal transformation to form aerodynamic shapes	**Apply**
CO3	Apply potential flow theory to solve airfoil characteristics	**Apply**
CO4	Apply Prandtl's lifting line theory to predict finite wing properties	**Apply**
CO5	Illustrate the effect of boundary layer on flow over objects	**Understand**

UNIT - I

POTENTIAL FLOW: Introduction, Laplace's Equation, Basic Flows – Uniform Parallel Flow, Source, Sink, Simple Vortex, Doublet, Combination of Simple Flows-Flow Past a Half Body, Rankine Oval, Flow Past a Circular Cylinder without Circulation and with Circulation, Kutta-Joukowsky Theorem

UNIT - II

CONFORMAL TRANSFORMATION: Introduction, Basic Principles, Methods for Performing Transformation, Kutta-Joukowski Transformation, Transformation of Circle to Straight Line, Transformation of Circle to Ellipse, Transformation of Circle to Symmetrical Aerofoil, Transformation of Circle to Cambered Aerofoil

UNIT - III

THIN AEROFOIL THEORY: Introduction, Aerofoil Characteristics, Vortex Sheet, Kutta Condition, Kelvin's Circulation Theorem, Starting Vortex, Thin Aerofoil Theory-Symmetrical Aerofoil and Cambered Aerofoil.

UNIT - IV

FINITE WING THEORY: Introduction, Down Wash, Induced Drag, Trailing Vortex, Vortex Filament, Biot-Savart Law and Helmholtz Theorems, Prandtl's Classical Lifting Line Theory-Elliptic Lift Distribution, General Lift Distribution.

UNIT - V

BOUNDARY LAYER: Introduction, Boundary Layer Development, Boundary Layer Thickness, Displacement Thickness, Momentum Thickness, Energy Thickness, Types of Boundary Layer, Momentum Integral Estimates- Karman Analysis of the Flat Plate, Boundary Layer Equations-2D Flow, Boundary Layer Growth on a Flat Plate-Blasius Solution, Boundary Layer with Pressure Gradient

TEXT BOOKS:

1. Anderson, J.D., Fundamentals of Aerodynamics", Sixth Edition, McGraw-Hill Book Co., New York, 2017.
2. Rathakrishnan. E, Theoretical Aerodynamics, Wiley, 2013.

REFERENCE BOOKS:

1. Houghton. E. L., Carpenter P. W, Collicott. C. H, Valentine. D. T, Aerodynamics for Engineering students, Seventh Edition, Elseveir, 2017.
2. Milne-Thomson. L. H., Theoretical aerodynamics, Courier Corporation, 2012.
3. Clancy. J. L, Aerodynamics, Sterling Book House, 2006.

Online Learning Resources:

- https://archive.nptel.ac.in/courses/101/105/101105059/

B.Tech II Year II Semester	23AE53 - MANUFACTURING TECHNOLOGY LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To acquire basic knowledge of casting process
- To demonstrate various joining processes using welding
- To demonstrate lathe machine and special machine operations

Course Outcomes:

COs	Statements	Blooms Level
CO1	Develop various products using casting	**Apply**
CO2	Fabricate machine components with suitable welding, lathe and other machining operations	**Apply**
CO3	Manufacture plastic components using various plastic processing techniques	**Apply**

I. METAL CASTING LAB

1. Pattern Design and making - for one casting drawing.
2. Moulding, Melting and Casting - 1 Exercise

II. WELDING LAB

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 2 Exercises

III. PROCESSING OF PLASTICS

1. Injection Moulding
2. Blow Moulding

IV. MACHINE TOOLS LAB

1. Lathe Operations
2. Special Machines: Drilling, Shaping, Milling Grinding (Surface Grinding).
3. Preparation of Single Point Cutting Tool

References: Lab manuals.

B.Tech II Year II Semester	23AE54 - SOLID MECHANICS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

To learn the methods to predict the response of a structure under loading and it susceptibility to various failure modes

Course Outcomes:

COs	Statements	Blooms Level
CO1	Analyze the various materials under different equilibrium loading conditions.	**Analyze**
CO2	Perform tests and analyze materials subjected to tension, torsion, bending, and bucking	**Apply**

LIST OF EXPERIMENTS

(Any of the 10 experiments are required to be conducted)

1. Tension test on metal bar.
2. Compression test on helical spring.
3. Torsion test on square metal bar.
4. Brinell hardness test on metals.
5. Rockwell Hardness test on metals
6. Impact test on metal specimen i) Izod ii)Charpy
7. Shear test on metals
8. Bending test on solid metal specimen
9. Bending test on hollow metal specimen
10. Deflection test on Simply supported beam
11. Deflection test on Cantilever beam
12. Deflection test on Overhang beams.

REFERENCE: Lab Manual

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).

B.Tech II Year II Semester	23AES2 - MATLAB APPLICATIONS IN ENGINEERING LAB	L	T	P	C
		0	1	2	2

Course Educational Objectives: This course is designed to use the basic in-built commands and to write the MATLAB code to solve ordinary differential equation, integration and make the user-friendly environment using graphical user interface.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply the basic MATLAB operations in basic engineering problems	**Apply**
CO2	Solve the system of linear algebraic equation using matrix operation	**Apply**
CO3	Apply the graphical user interface to write the code as more user friendly	**Apply**

LIST OF EXPERIMENTS

Part – I: Introduction to MATLAB

1. (a) Find the sum of first100 natural numbers (b) Perform Basic matric operations?
2. (a) Write a MATLAB program that adds all elements of an array named S with even indices. (b) Perform double integration problems?
3. Find the roots of a linear equations by using Newton's and Secant Method.
4. (a) Introduction to basic plots 2D, 3D (b) MATLAB Graphical user interface – addition and subtraction

Part – II: Application of MATLAB

5. Write a MATLAB Code to determine Lift Curve Slope from the given parameters?
6. Solving of ordinary differential equation using Runge-Kutta method a numerical approach
7. (a) Write a MATLAB Code to determine Compute the Laplace transform of 1/sqrt(x) (b) Write a MATLAB Code to determine Eigenvalues and eigenvectors of a linear algebraic equations
8. (a) Solve System of Linear Equations (b) Solve system of nonlinear equations
9. Graphics – kinematics of particle – position, velocity, and acceleration
10. Develop the graphical user interface to identify the area moment of inertia of simple section – trapezoidal and triangle.
11. Identification of shear force and bending moment diagram of cantilever beam with point load
12. MATLAB Graphical user interface: Design and develop a scientific calculator

Online Learning Resources:

- https://www.mathworks.com/solutions/cloud/resources.html
- https://www.edx.org/learn/matlab/mathworks-matlab-essentials?index=product&objectID=course-28ae36f9-40f5-4049-8fca-a93b5c486e81&webview=false&campaign=MATLAB+Essentials&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fmatlab

B.Tech II Year II Semester	23ME57 - DESIGN THINKING AND INNOVATION	L	T	P	C
		1	0	2	2

Course Objectives:

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Apply fundamental design components, principles, and new materials to create and improve design projects.	**Apply**
CO2	Apply the design thinking process to develop and present innovative product solutions	**Apply**
CO3	Analyze the relationship between creativity and innovation, evaluate their roles in organizations, and develop strategic plans for transforming creative ideas into innovative solutions	**Analyze**
CO4	Analyze to work in a multidisciplinary environment	**Analyze**
CO5	Apply design thinking principles to address business challenges, develop and test business models and prototypes, and evaluate the value of creativity	**Evaluate**

UNIT – I Introduction to Design Thinking

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

UNIT – II Design Thinking Process

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

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

UNIT – III Innovation

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

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

UNIT – IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.
Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.
Activity: How to market our own product, about maintenance, Reliability and plan for startup.

TEXT BOOKS:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

REFERENCE BOOKS:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

V SEM

B.Tech. (V Sem.) **23AE07 - AEROSPACE VEHICLE STRUCTURES**

L	T	P	Cr.
3	0	0	3

Pre-requisites: Engineering Mechanics and Strength of Materials

Course Educational Objectives: To comprehend fundamentals of elasticity and failure theories, analysis of various Aerospace structural components under various loading conditions and application of energy methods to structural components.

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

COs	Statements	Blooms Level
CO1	Apply the stress and strain relations in elastic members and relevant failure theories to aerospace components.	Apply
CO2	Evaluate statically indeterminate beam structures subjected to various loading conditions.	Apply
CO3	Apply strain energy methods and theorems to beams and trusses under different loading conditions	Apply
CO4	Analyze the stability and critical buckling loads of columns under axial and eccentric loadings	Analyze
CO5	Estimate bending stresses in beams subjected to unsymmetrical bending	Apply

UNIT - I

BASIC ELASTICITY: Basic Elasticity Stresses and Strains, Equations of Equilibrium, Plane Stress and Plane Strain Problems, Compatibility Equations, Stress - Strain Relations, Airy's Stress Function.

Failure Theories: Maximum Stress Theory – Maximum Strain Theory – Maximum Shear Stress Theory –Distortion Energy Theory – Maximum Strain Energy Theory

UNIT - II

STATICALLY INDETERMINATE STRUCTURES: Methods for Indeterminate Beams- Indeterminate structure, order of redundancy, Propped Cantilever- Fixed-Fixed Beams- Continuous Beams Carrying Point Load And Uniformly Distributed Load- Shear Force and Bending Moment Diagrams, Clapeyron's Three Moment Equation.

UNIT - III

AIRCRAFT STRUCTURAL COMPONENTS AND ENERGY METHODS: Aircraft Structural components and loads, functions of structural components, airframe loads; Types of structural joints, type of loads on structural joints.

Strain Energy– Strain Energy Stored in a Beam due to Axial Load, Bending Moment - Castigliano's First and Second Theorems -Maxwell's Reciprocal Theorem, Unit Load Method - Application to Beams and Trusses.

UNIT – IV

COLUMNS: Introduction- Axially Loaded Compression Members-Crushing Load- Buckling Load-Euler's Theory-Effective Length of Column-Expressions for Buckling Load With Different Column End Conditions- Limitations-Euler's Formula- Rankine's Formula – Columns Subjected to Eccentric Loading.

UNIT-V

UNSYMMETRICAL BENDING: Introduction - Principal Axis and Neutral Axis Methods, Bending Stresses - Beams of Symmetric Sections with Symmetric and Skew Loads - Beams of Unsymmetrical Sections with Symmetric and Skew Loads.

TEXT BOOKS:

1. T.H.G. Megson – Aircraft Structures for Engineering Students, 6th Edition, Butterworth-Heinemann, 2016.
2. Ramamrutham, S., and Narayanan, R. (2022). Theory of Structures, 11th Edition, Dhanpat Rai Publishing Company.

REFERENCE BOOKS:

1. Bruce K. Donaldson – Analysis of Aircraft Structures: An Introduction, 2nd Edition, Cambridge University Press, 2008.
2. R.C. Hibbeler – Mechanics of Materials, 10th Edition, Pearson Education, 2016.
3. S. Timoshenko and D.H. Young – Elements of Strength of Materials, 5th Edition, CBS Publishers, 2017.

B.Tech. (V Sem.)	23AE08-GAS DYNAMICS	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Engineering Fluid Mechanics, Engineering Thermodynamics, Aerodynamics

Course Educational Objectives: To learn the basic concepts of compressible fluid flows, properties of steady one-dimensional flow and supersonic flows, compressible flow with friction and heat transfer and compressible flow over wings

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

COs	Statements	Blooms Level
CO1	Apply the of compressible fluid flow equations to solve flow problems	Apply
CO2	Apply steady one-dimensional flow principles in designing nozzles and diffusers	Apply
CO3	Analyze the supersonic flow behavior over objects	Analyze
CO4	Analyze fluid flow through ducts by considering friction and heat transfer affects	Analyze
CO5	Apply compressible flow theory to analyze flow over wings	Apply

UNIT - I

BASICS OF COMPRESSIBLE FLOW: Introduction, Compressibility, Basic Equations of Compressible Flow- Energy Equation, Isentropic Flow Relations, Stagnation Properties, Speed of Sound, Mach Number, Mach Cone, Wave Propagation

UNIT - II

STEADY ONE-DIMENSIONAL FLOW: Introduction, Fundamental Equations, Discharge from A Reservoir, Critical Values, Stream Tube Area-Velocity Relation, Area-Mach Number Relation, Types of Nozzles, Isentropic Flow Through Nozzles, Diffusers, Compressibility Correction to Dynamics Pressure

UNIT - III

SHOCK AND EXPANSION WAVES: Introduction, Types of Waves, Normal Shock-Equations of Motion, The Normal Shock Relations for Perfect Gas, Hugoniot Equation, Oblique Shocks-Relation Between β-θ-M, Shock Polar, Detached Shocks, Expansion Waves, Prandtl-Meyer Flow, Simple and Non-Simple Regions, Flow with Shocks and Expansion Waves at the Exit of a Convergent- Divergent Nozzle, Mach Angle, Mach Wave.

UNIT - IV

FLOW WITH FRICTION AND HEAT TRANSFER: Introduction, Flow in Constant Area Duct with Friction, Adiabatic Constant Area Flow of a Perfect Gas, Fanno Line Flow, Flow with Heating and Cooling in Ducts, Rayleigh Line Relation.

UNIT - V

COMPRESSIBLE FLOW OVER WINGS: Introduction, Potential Equation for Compressible Flow, Linearization of Potential Equation, Prandtl-Glauert Rule, Critical Mach Number, Drag-Divergence Mach Number, Area-Rule, Supercritical Aerofoil, Forward Swept and Swept Back Wings, Delta Wings

TEXT BOOKS:

1. Rathakrishnan. E, Gas Dynamics, 7th Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2021
2. John D Anderson, Jr. Fundamentals of Aerodynamics, 7th Edition, McGraw-Hill, 2024

REFERENCE BOOKS:

1. Ascher H. Shapiro, The dynamics and thermodynamics of compressible fluid flow Vol 1, The Ronald press Co. New York
2. Lipmann. H. W, Roshko. A, Elements of Gas Dynamics, Dover Special Priced Titles, 2007

B.Tech. (V Sem.) 23AE09 - AIRCRAFT SYSTEMS AND INSTRUMENTS

L	T	P	Cr.
3	0	0	3

Pre-requisites: Elements of Aerospace Engineering

Course Educational Objectives: To learn the conventional and modern control systems and working principle of different types of hydraulic and pneumatic systems, engine systems, auxiliary systems, and flight and navigation instruments used in an aircraft.

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

COs	Statements	Blooms Level
CO1	Identify the various types of controls in the airplane design	Understand
CO2	Understand the performance of hydraulic and pneumatic systems in the aircraft operation	Understand
CO3	Understand the working of various engine systems of an aircraft	Understand
CO4	Understand the functioning of auxiliary systems in the operation of an aircraft	Understand
CO5	Understand the working of various instruments necessary for the aircraft operation	Understand

UNIT - I

AIRPLANE CONTROL SYSTEMS: Conventional Control Surfaces–Power Assisted and Fully Powered Flight Controls – Power Actuated Systems, Engine Control Systems (FADEC), Push Pull Rod System – Operating Principles, Modern Control Systems – Digital Fly by Wire Systems – Auto Pilot System, Active Control Technology, Basic Aircraft Wiring Practices

UNIT - II

AIRCRAFT SYSTEMS: Hydraulic and Pneumatic Systems - Study of Typical Workable System – Components – Advantages, Working Principles - Typical Air Pressure System-Cabin pressurization, heating, cooling systems, Brake System-Typical Pneumatic Power System-Components, Landing Gear Systems – Classifications (Air Oleo)

UNIT - III

ENGINE SYSTEMS: Fuel Systems for Piston and Jet Engines, Components of Multi Engines, Modern Fuel system Components-Boot pumps, selector valves, ejector pumps, Lubricating Systems for Piston and Jet Engines, Electrical Starting and Ignition Systems,

UNIT - IV

AUXILIARY SYSTEM: Auxiliary power units (APU), Basic Air Cycle Systems – Vapour Cycle Systems - Boot-Strap Air Cycle System –Evaporative Vapour Cycle Systems – Evaporation Air Cycle Systems, Oxygen Systems, Ice and Rain protection systems- De-icing and Anti-Icing System, Fire Protection Systems, Aircraft Warning System-Caution, Advisory and Fault Alerts

UNIT - V

AIRCRAFT INSTRUMENTS: Flight and Navigation Instruments Principles and Operation– Accelerometers, Air Speed Indicators – Mach Meters – Altimeters - Gyroscopic Instruments, VOR, DME, GPS, INS, Study of Various Types of Engine Instruments Operation and Principles – Tachometers – Temperature Gauges – Pressure Gauge.

TEXT BOOKS:

1. McKinley. J. L, Bent. R.D, Aircraft Maintenance and Repair, McGraw-Hill, 1993.
2. General Hand Books of Airframe and Power Plant Mechanics, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi, 1995.

REFERENCE BOOKS:

1. Mekinley. J. L, Bent. R. D, Aircraft Power Plants, McGraw-Hill, 1993.
2. Pallet. E. H. J, Aircraft Instruments and Principles, Pitman and Co, 1993.
3. Treager. S, Gas Turbine Engine Technology, Third Edition, McGraw-Hill Education.

L	T	P	Cr.
3	0	0	3

B.Tech. (V Sem.) **23AE10 - INDUSTRIAL AERODYNAMICS**

Pre-requisites: Aerodynamics

Course Educational Objectives: The course is intended to understand the aerodynamic aspects of wind generators, automobiles, buildings, bird, importance in recent industries.

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

COs	Statements	Blooms Level
CO1	Understand the aerodynamics effects on wind turbines, buildings and its ventilation	Understand
CO2	Understand the effects of aerodynamics in automobiles	Understand
CO3	Understand the effects of wind and flow induced vibrations over objects	Understand
CO4	Apply the effects of aerodynamics in flapping wing vehicles	Apply

UNIT I

WIND ENERGY AND WIND TURBINES: Types of Winds, Causes of Variation of Winds, Atmospheric Boundary Layer, Effect of Terrain On Gradient Height. Horizontal Axis and Vertical Axis Machines, Power Coefficient, Betz Coefficient by Momentum Theory.

UNIT II

GROUND VEHICLE AERODYNAMICS: Sources of Drag in Ground Vehicles**,** Power Requirement and Drag Coefficients of Automobiles, Aerodynamics of Passenger Cars, Race Cars, Motorcycles, Trains

UNIT III

BUILDING AERODYNAMICS: Pressure Distribution On Low Rise Buildings, Wind Forces On Buildings, Environmental Winds in City Blocks, Special Problems of Tall Buildings, Building Codes, Building Ventilation and Architectural Aerodynamics.

UNIT IV

FLOW INDUCED VIBRATIONS: Effect of Reynolds Number On Wake Formation of Bluff Shapes, Vortex Induced Vibrations, Buffeting, Vortex Shedding, Galloping and Flutter.

UNIT V

FLAPPING WING AERODYNAMICS: Bird Wing Parts, Unpowered Flight-Gliding and Soaring, Powered Flight-Flapping, Hovering, Take-Off and Landing, The Physics of Drag and Thrust Generation Due to Wing Flapping, Flapping Wing Kinematics

REFERENCE BOOKS:

1. T. Yomi Obidi, Theory and Applications of Aerodynamics for Ground Vehicles, SAE International, 2014.
2. Lawson, Building Aerodynamics, Cambridge University Press, 2010.
3. Tomomichi Nakamura, Shigehiko Kaneko, Flow-Induced Vibrations: Classifications and Lessons from Practical Experiences, Second Edition, Academic Press, 2013.
4. Wei Shyy, Hikaru Aono, Chang-kwon Kang, Hao Liu, An Introduction to Flapping Wing Aerodynamics, Cambridge University Press, 2013

L	T	P	Cr.
3	0	0	3

B.Tech. (V Sem.) **23AE11- FINITE ELEMENT ANALYSIS**

Pre-requisites: Numerical Methods and Transform Techniques, Strength of Materials

Course Educational Objectives: To Apply the mathematical modeling and Numerical methods to the Structural Engineering problems by introducing Finite Element methods and help the students to Analyze the Aerospace Structural problems with the help of software packages.

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

COs	Statements	Blooms Level
CO1	Apply mathematical model for solution of common engineering problems	Apply
CO2	Solve 2-Dimensional Structural Problems using CST Element	Apply
CO3	Apply Axi-symmetric modelling concepts to solids of revolution for stress approximation	Apply
CO4	Analyze the structural behavior of Trusses and Beams Elements	Analyze
CO5	Estimate the natural frequencies and mode shapes of the bar elements	Apply

UNIT - I

INTRODUCTION TO FINITE ELEMENT METHODS: Stress and Equilibrium, Stress – strain relations; Strain – Displacement relations.

One Dimensional Problems: Finite element modeling coordinates and shape functions, Potential Energy approach, Assembly of Global stiffness matrix and load vector, Finite element equations, Treatment of boundary conditions.

UNIT – II

TWO-DIMENSIONAL PROBLEMS: Finite element modeling **-**Constant Strain Triangles (CST) – Isoparametric Representation-Shape functions, Stiffness matrix, Strain-Displacement matrix, Force terms- Stress Calculations

UNIT - III

FINITE ELEMENT MODELING OF AXISYMMETRIC SOLIDS: Axisymmetric solids subjected to axisymmetric loading with triangular elements, Two dimensional four noded isoparametric elements, problems on isoperimetric formulation of four nodes quadrilateral element, Numerical Integration-Gauss quadrature

UNIT - IV

ANALYSIS OF TRUSSES AND BEAMS: Introduction**-** Plane Trusses- Local and Global Coordinate Systems-Transformation Matrix- Element Stiffness Matrix-Stress Calculations. Hermite shape functions, Element stiffness matrix, Load vector, Boundary conditions

UNIT - V

DYNAMIC ANALYSIS: Formulation of finite element model, Lumped and consistent mass matrices, Evaluation of Eigen values and Eigen vectors for a stepped bar.

REFERENCE BOOKS:

1. Chandraputla, Ashok, Belegundu., Introduction to Finite Elements in Engineering, 5th edition, Pearson Education India, 2015
2. Rao.S.S, The Finite Element Methods in Engineering, 4th edition, 6th reprint, B.H. Pergamon, 2010.
3. Reddy.J.N, An introduction to Finite Element Method, 4th edition, McGraw Hill, 2020.
4. Kenneth H. Huebner, Donald L. Dewhirst, Douglas E Smith, Ted G. Byrom., The Finite Element Method for Engineers, 4th edition, John Wiley and sons (ASIA) Pvt Ltd, 2001.
5. David Hutton., Fundamentals of Finite Element Analysis, Tata McGraw Hill, 2005.

L	T	P	Cr.
3	0	0	3

B.Tech. (V Sem.) **23AE12 - UAV SYSTEMS DESIGN**

Pre-requisites: Introduction to Aerospace Engineering, Basic Electrical and Electronics Engineering

Course Educational Objectives: To study the basic terminologies, the integration methods and subsystems to construct the UAVs and MAVs and the flight performance parameters of UAVs and MAVs.

Course Outcomes (COs): At the end of the semester, the student will be able to

COs	Statements	Blooms Level
CO1	Understand the basic needs to design UAV and MAV	Understand
CO2	Acquire the knowledge and importance of payload integration with UAV airframe	Understand
CO3	Apply the advanced concepts of UAV and MAV system design to the engineers	Apply
CO4	Understand the performance of UAVs and MAVs subsystems for stable fly	Understand

UNIT I

INTRODUCTION TO UAV AND MAV: Historical Background of UAV and MAV - Classifications Based on Range and Endurance –Basic Terminologies -Models and Prototypes - Preliminary, Conceptual and Detailed Design Stages.

UNIT II

AIRFRAME DESIGN: Fixed Wing -Rotor -VTOL-STOL- Blimp Wing Airframe - Flapping Wing - Dynamics –Modeling Fuselage Structures -Airfoil Selection - Propeller Selection- Empennage Design -Flight Control Surfaces Specifications- Airframe Maintenance.

UNIT III

HARDWARE SUPPORT: Propulsion Unit - Selection of Motors and Battery-UAV and MAV Airframe Weight Calculations - Payloads -Autopilot Sensors-Servos-Accelerometer -Gyros-Actuators- Power Supply Processor, Integration, Installation, Configuration.

UNIT IV

PAYLOADS AND COMMUNICATIONS: Non-dispensable Payloads, Dispensable Payloads, Communication Media Radio Communication, Mid-air Collision (MAC) Avoidance, Communications Data Rate, Bandwidth Usage Antenna Types

UNIT V

ASSEMBLY: Introduction, Assembling the UAV Empennage, Wiring and Servo Motors - Problems in Wiring Installation, Wings, RC- Control Techniques

REFERENCE BOOKS:

1. Austin. R, Unmanned Air Systems: UAV Design, Development and Deployment, Wiley Publishers, 2015.
2. Leszek. C, Adamski. M, Power units and power supply systems in UAV, Taylor and Francis Group publishers, 2014.
3. Skafidas, Microcontroller Systems for a UAV- Auto Piloting and Camera Triggering System, KTH, TRITA-FYS 2002:51 ISSN 0280-316 X. 34, 2002.
4. Droneprep, Unmanned Aircraft Systems Logbook for Drone Pilots and Operators, Create Space Independent Publishing Platform, 2015.
5. Griffis, C., Wilson, T., Schneider, J, Pierpont, P, Unmanned Aircraft System Propulsion Systems Technology Survey, 2009.

B.Tech. (V Sem.)	23AE13 – COMPUTER AIDED DESIGN AND MANUFACTURING	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Manufacturing Technology

Course Educational Objective: The main objective of this course is to familiarize the principles of geometric modeling, numerical control and part programming.

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

COs	Statements	Blooms Level
CO1	Understand the principles of CADM for design and manufacturing.	Understand
CO2	Formulate mathematical equations for geometrical entities like curves, surface, and solids.	Apply
CO3	Write the program for part profiles to accomplish numerical control machining	Apply
CO4	Discuss the codes for different parts using GT and apply in automated manufacturing systems.	Understand
CO5	Contrast CAQC techniques and comprehend the applications of Computer Integrated Manufacturing.	Understand

UNIT - I

FUNDAMENTALS OF CAD: Introduction – The design process – The application of computers for Design-Product Cycle -Engineering data management– Benefits of CAD.

COMPUTER GRAPHICS: Raster scan Graphics-Display Devices-Coordinate Systems-Database structure for graphics Modeling-Transformation of geometry: Translation, scaling, reflection, rotation, homogeneous transformations

UNIT – II

GEOMETRIC MODELING: REPRESENTATION OF CURVES, SURFACES AND SOLIDS: Introduction, wireframe models, curve representation, parametric representation of analytical curves, Bezier and B-Spline curves. Introduction to surfaces, surface models surface entities. Introduction to solids, solid models, solid entities, Fundamentals of solid modeling, Boundary representation, CSG representation, sweep representation.

UNIT – III

COMPUTER NUMERICAL CONTROL: Introduction – NC modes – NC elements -NC Coordinate systems – Structure of CNC Machine Tools – Spindle design –Spindle drives – Feed drives – actuation systems.

PART PROGRAMMING: Part programming Fundamentals – Manual part programming-computer aided part programming.

UNIT - IV

GROUP TECHNOLOGY: Introduction – part families – part classifications and coding – OPITZ system – MICLASS system – CODE system – GT Machine cells – Benefits of GT – CAPP: Retrieval type and generative type

FLEXIBLE MANUFACTURING SYSTEM: Introduction – FMS components – Benefits of FMS – FMS planning and implementation Issues.

UNIT - V

COMPUTER AIDED QUALITY CONTROL: Introduction –computers in QC – Contact Inspection methods – Non contact inspection methods: optical, non-optical –Computer Aided Testing-Integration of CAQC with CAD/CAM.

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Introduction–Integration-CIM implementation – Benefits of CIM – Lean manufacturing.

REFERENCE BOOKS:

1. Mikel P.Groover and Emory W.Zimmers, CAD/CAM-prentice Hall of India private Ltd.New Delhi, 20th edition, May 2010.

2. Ibrahim Zeid, Mastering CAD/CAM, TATA McGraw-Hill publishing CO.Ltd, New Delhi2011.

3. PN Rao,CAD/CAM Principle and applications, Tata McGraw Hill Education Private Ltd,New Delhi,8th edition 2013.

4. P.Radhakrishnan, S.Subramanyam and V.Raju, CAD/CAM/CIM,New Age International Publishers,3rd edition 2010.

B.Tech. (V Sem.)	23AE55 - AERODYNAMICS LAB	L	T	P	Cr.
		0	0	3	1.5

Course Educational Objectives:
To learn the basic experiments in wind tunnel, open jet facility and basic flow visualization techniques

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

COs	Statements	Blooms Level
CO1	Analyze the flow characteristics over aerodynamic bodies	Analyze
CO2	Analyze nozzle flow characteristics	Analyze

Any of the 10 Experiments are required to be conducted

1. Determination of lift and drag for the symmetrical aerofoil.
2. Determination of lift and drag for the cambered aerofoil.
3. Determination of center of pressure and aerodynamics center for symmetrical and cambered airfoil
4. Generation of potential flow pattern over objects using Hele-Shaw Apparatus.
5. Visualization of flow field around a flat plate using open channel.
6. Pressure Distribution over a smooth circular cylinder.
7. Pressure Distribution over a symmetrical aerofoil.
8. Pressure Distribution over a cambered aerofoil.
9. Flow visualization over objects using smoke tunnel.
10. Yaw effect on Pitot probe and Pitot-Static probe in incompressible and compressible flows
11. Flow thorough Convergent Nozzle
12. Flow through Convergent- Divergent Nozzle
13. Supersonic Flow Visualization using Shadowgraph Technique.
14. Flow visualization of submerged water jet

B.Tech. (V Sem.)	23AE56- AIRCRAFT COMPONENT MODELLING USING CATIA	L	T	P	Cr.
		0	0	3	1.5

Course Educational Objective: To provide hands-on training in CATIA software for modelling of aircraft components.

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

COs	Statements	Blooms Level
CO1	Create, modify, and constrain 2D sketches for component design	Apply
CO2	Develop 3D models and assemble various aircraft components using CATIA	Apply

List of Experiments:

(Any 10 experiments to be performed from the following list):

1. Design and modelling of basic 2D sketches using Sketcher workbench
2. Modelling of basic 3D parts using Part Design workbench
3. Design of aircraft wing structural elements
4. Design of aircraft fuselage structural elements
5. Modelling of landing gear components
6. Modelling of jet engine components
7. UAV component design using part modelling techniques
8. Design and drafting of conventional aircraft components
9. Assembly of a knuckle joint
10. Assembly of a radial engine
11. Assembly of wing elements
12. Assembly of fuselage components
13. Assembly of landing gear system
14. Assembly of a conventional aircraft structure
15. Assembly of jet engine components

B.Tech. (V Sem.)	23AES3 - COMPUTATIONAL STRUCTURAL ANALYSIS LAB	L	T	P	Cr.
		0	1	2	2

Course Educational Objectives: To provide hands-on training in using ANSYS for finite element analysis (FEA) on behavior of aerospace and mechanical structural components under various static and dynamic loading conditions.

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

COs	Statements	Blooms Level
CO1	Perform static structural analysis on beams, trusses, and other structural elements using FEA tools.	Apply
CO2	Analyze aircraft structural components for deformation, stress distribution, and failure criteria.	Analyze

MODULE-I
INTRODUCTION TO FEA AND ANSYS
Fundamentals of Finite Element Analysis (FEA), Overview of ANSYS Workbench and APDL environment, Problem-solving strategy using FEA, Units, boundary conditions, and post-processing basics.

MODULE-II
DESIGN AND MODELING TECHNIQUES: DESIGN MODELER: Creating and modifying geometry using Design Modeler, Sketching tools and part modelling concepts, Solid modelling strategies for structural components, Geometry simplification and repair for FEA.

MODULE-III
TYPES OF STRUCTURAL ANALYSIS: Static structural analysis**,** Modal and buckling analysis**,** Introduction to dynamic analysis (transient, harmonic)**,** Brief overview of nonlinear analysis and its applications.

MODULE-IV
STATIC AND MODAL ANALYSIS OF BEAMS- trusses, and other basic structural components

STRUCTURAL ANALYSIS OF AIRCRAFT COMPONENTS: Wing sections, Fuselage panels, Landing gear elements

Analysis of composite structures.

MODULE-V
ADVANCED FEA CONCEPTS: Introduction to ANSYS Parametric Design Language (APDL)**,** Workflow automation and scripting basics**,** Meshing strategies and contact analysis**,** Solver settings, convergence criteria, and error reduction**,** Material modeling for metallic and composite structures.

B.Tech. (V Sem.) **23EM01-TINKERING LAB**

L	T	P	C
0	0	2	1

PRE-REQUISITES: Design Thinking and Innovation.

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to understand the basics of all the emerging technologies and apply the learnings to solve real-world problems. This is designed to be a hands-on learning program that empowers students to analyze the facts, connect the dots and apply what they learn in school rather than memorizing them which will lead to the creation of the next generation of entrepreneurs, engineers and innovators.

COURSE OUTCOMES: At the end of the course students will be able to

COs	Statements	Blooms Level
CO1	Turn ideas into reality by brainstorming, modelling and prototyping.	**Apply**
CO2	Inculcate innovative and entrepreneurial mind-set through Design thinking and Hands-on Learning	**Apply**
CO3	Develop basic knowledge in electrical and mechanical engineering principles.	**Apply**
CO4	Develop skills of using hand tools to construct a prototype of an engineering design.	**Apply**

List of Experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Demonstrate a traffic light circuit using breadboard.
3) Build and demonstrate automatic Street Light using LDR.
4) Simulate the Arduino LED blinking activity in Tinkercad.
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6) Interfacing IR Sensor and Servo Motor with Arduino.
7) Blink LED using ESP32.
8) LDR Interfacing with ESP32.
9) Control an LED using Mobile App.
10) Design and 3D print a Walking Robot
11) Design and 3D Print a Rocket.
12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13) Demonstrate all the steps in design thinking to redesign a motor bike.

REFERENCE BOOKS: Lab Manual

WEB REFERENCES: Students need to refer to the following links:

1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2) https://atl.aim.gov.in/ATL-Equipment-Manual/
3) https://aim.gov.in/pdf/Level-1.pdf
4) https://aim.gov.in/pdf/Level-2.pdf
5) https://aim.gov.in/pdf/Level-3.pdf

VI SEM

B.Tech. (VI Sem.) 23AE14 AIRCRAFT STRUCTURES AND VIBRATIONS

L	T	P	Cr.
3	0	0	3

Pre-requisites: Solid Mechanics, Aerospace Vehicle structures

Course Educational Objectives: To comprehend shear flow and shear centers in thin-walled sections, bending and buckling behavior of thin plates and stiffened panels located in fuselage, wing and landing gear, free and forced vibration of systems

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

COs	Statements	Blooms Level
CO1	Determine shear flow and locate shear centres in open and closed thin-walled sections	Apply
CO2	Analyze the bending and buckling behavior of thin plates under various loading conditions	Analyze
CO3	Analyse the shear flow distribution in aircraft structural members	Analyze
CO4	Formulate behaviour of systems with single degree of freedom under free vibrations	Apply
CO5	Analyse the forced vibration response of single degree of freedom systems	Analyze

UNIT I – SHEAR FLOW AND SHEAR CENTRE IN THIN-WALLED SECTIONS:
Thin-walled beam assumptions – open and closed sections, Shear flow in symmetrical and unsymmetrical cross-sections, Location of shear centre – applications in aircraft components, Bredt–Batho theory-single- and multi-cell structures, Torsion of thin-walled sections – comparison between open and closed, Thin-wall bending – concept of effective and ineffective areas.

UNIT II – BENDING AND BUCKLING OF THIN PLATES:
BENDING OF PLATES: pure bending, twisting, transverse loads, In-plane loading – isotropic rectangular plate assumptions.
Buckling of Thin Plates: Introduction to elastic and inelastic buckling of thin plates, Local instability and panel buckling, Critical stress estimation in stiffened panels.

UNIT III – STRESS ANALYSIS IN WING AND FUSELAGE STRUCTURES:
Overview of aircraft structural members: spars, ribs, stringers, Stress analysis in wing box beams and fuselage frames, Shear Resistant Web Beams, Shear flow analysis in multi-cell structures, Tension field theory (Wagner's theory), Step-wise procedure for determining shear flow and bending stresses.

UNIT IV – FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM (SDOF) SYSTEMS:
Introduction-Free vibrations of undamped systems – torsional and translational, Equivalent stiffness: springs in series and parallel, Energy methods to determine natural frequency.
Introduction-Types of damping: viscous, Coulomb, structural, Solutions for underdamped, overdamped, critically damped systems, Logarithmic decrement and damping estimation methods.

UNIT V – FORCED VIBRATIONS AND ISOLATION IN SDOF SYSTEMS

Introduction-Steady-state response under harmonic excitation, Rotating and reciprocating unbalance – excitation of base, Vibration isolation and transmissibility concepts, Use of typical isolators and mountings in aerospace, Vibration Measuring Instruments: vibrometers, accelerometers.

TEXT BOOKS

1. T. H. G. Megson, Aircraft Structures for Engineering Students – 7th Edition (2021), Elsevier
2. Singh, V. P., and Pratap, R. Mechanical Vibrations-5th edition. Dhanpat Rai and Co. 2015.

REFERENCE BOOKS:

1. Peery, D. J., and Azar, J. J. Aircraft structures, 2nd edition. McGraw-Hill. Dover Publications, 2007.
2. Bruhn, E. F. Analysis and design of flight vehicle structures. Jacobs Publishing 1973.
3. Rivello, R. M. Theory and analysis of flight structures. McGraw-Hill-1993.
4. Grover, G. K. Mechanical vibrations: M.K.S. systems, 8th edition. Nem Chand and Bros-2009.

B.Tech. (VI Sem.) **23AE15- AIR BREATHING PROPULSION**

L	T	P	Cr.
3	0	0	3

Pre-requisites: Engineering Thermodynamics, Elements of Aerospace Engineering

Course Educational Objectives: To learn engineering concepts of jet engines, flow through subsonic and supersonic inlets of a jet engine, principle of operation of aircraft jet engines, fundamentals of combustion process.

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

COs	Statements	Blooms Level
CO1	Determine the performance parameters of various jet engines	Apply
CO2	Understand flow thorough subsonic and supersonic inlets	Understand
CO3	Estimate the performance parameters of aircraft compressor	Apply
CO4	Understand and identify the parameters governing the combustion process	Understand
CO5	Determine the performance parameters of turbines of jet engines	Apply

UNIT - I

FUNDAMENTALS OFAIRBREATHING PROPULSION: Working of Gas Turbine Engine, Characteristics of Turboprop, Turbofan, And Turbojet - Cycle Analysis, Performance Characteristics of turbojets and turbofans, Thrust Equation - Factors Affecting Thrust — Methods of Thrust Augmentation. Ramjet and Scramjet.

UNIT - II

SUBSONIC AND SUPERSONIC INLETS: Introduction, Subsonic Inlets - Internal Flows - External Flow, Relation between minimum area ratio and external deceleration ratio - Supersonic Inlets – Starting Problem On Supersonic Inlets - Shock-Swallowing - Modes of inlet operation - Flow Stability Problem

UNIT - III

COMPRESSORS: Principle of Operation of Centrifugal Compressor – Work Done and Pressure Rise – Velocity Diagrams – Diffuser Vane Design Considerations – Concept of Prewhirl, Stall and Surge, Elementary Theory of Axial Flow Compressor – Velocity Triangles – Degree of Reaction, Centrifugal and Axial Compressor Performance Characteristics.

UNIT - IV

COMBUSTION CHAMBERS: Classification of Combustion Chambers, Combustion Process, Important Factors Affecting Combustion Chamber Design– Combustion Chamber Performance – Effect of Operating Variables on Performance, Flame Tube Cooling, Flame Stabilization, Use of Flame Holders, Fuel Injection System.

UNIT - V

TURBINES: Elementary Theory of Turbines - Impulse and Reaction Turbines, Axial Flow Turbine, Radial Flow Turbine, Velocity Triangles and Power Output, Estimation of Stage Performance, Turbine Performance Characteristics, Methods of Blade Cooling

TEXT BOOK

1. Ganesan. V, Gas Turbines, Third Edition, Tata McGraw-Hill, New Delhi, 2017
2. Saravanamuttoo. H.I.H, Rogers. G. F. C, Cohen. H,Straznicky. P. V, Nix. A. C, Gas Turbine Theory, Seventh Edition,Pearson Education, 2019.

REFERENCE BOOKS:

1. Hill, P.G., Peterson, C.R. Mechanics and Thermodynamics of Propulsion, Addison – Wesley. Longman INC, 1999.
2. Mattingly.J.D, Elements of propulsion: Gas Turbines and Rockets, AIAA Educational Series
3. Rolls Royce Jet Engine, Third Edition, 1983.

B.Tech. (VI Sem.) **23AE16- FLIGHT DYNAMICS**

L	T	P	Cr.
3	0	0	3

Pre-requisites: Engineering Mechanics, Aerodynamics

Course Educational Objectives: To learn the concepts of steady level and maneuvering flight performances at various operating conditions, static-dynamic stability and control of an aircraft.

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

COs	Statements	Blooms Level
CO1	Determine thrust and power requirement conditions for steady level flight	Apply
CO2	Estimate performance parameters of flight during manoeuvring	Apply
CO3	Apply the conditions of static stability and control in the aircraft design	Apply
CO4	Analyze the stability of aircraft under dynamic modes	Analyze

UNIT-I

STEADY FLIGHT PERFORMANCE: Earth's Atmosphere, Concept of Drag-Drag polar, Equations of Motion in Steady Flight, Performance Design Parameters, Thrust Required and Thrust Available Conditions, Power Required and Power Available Conditions, Maximum Velocity, Effect of Drag Divergence

UNIT–II

MANOEUVRING FLIGHT: Rate of Climb, Hodograph Diagram, Gliding Flight, Service and absolute ceiling, time to climb, Range and Endurance for Propeller and Jet Aircrafts.

Accelerated Flight: Level turn, Constraints on Load Factor, Pull-Up and Pull-Down Manoeuvres, V-n Diagram, Take-off Performance, Landing Performance.

UNIT-III

STATIC LONGITUDINAL STABILITY AND CONTROL: Introduction, Moments on the Airplane, criteria for longitudinal static stability, Contribution of Wing to pitching moments, Contribution of Tail to pitching moments, Total Pitching Moment about the Center of Gravity, Neutral Point, Static Margin, Concept of Static Longitudinal Control, Calculation of Elevator Angle to Trim, Stick Fixed and Stick Free Stability.

UNIT-IV

STATIC LATERAL-DIRECTIONAL STABILITY AND CONTROL: Lateral stability-Dihedral effect, criterion for lateral stability, contribution of wing, fuselage, tail, lateral control-strip theory estimation of aileron effectiveness, aileron reversal.

Directional stability-yaw and sideslip, criterion of directional stability, contribution wing, fuselage, tail, Directional control- rudder control effectiveness, rudder requirements-adverse yaw, asymmetric power condition, spin recovery, Rudder lock and Dorsal fin,

UNIT - V

DYNAMIC STABILITY AND CONTROL:

Dynamic Longitudinal Stability: Modes of Stability, Aircraft Equations of motion, Small disturbance theory, Solving the stability quartic, Routh's discriminant, Phugoid motion, Short period of oscillation

Lateral and Directional Dynamic Stability- Spiral Divergence, Dutch Roll, Auto Rotation and Spin

TEXT BOOKS

1. Aircraft Performance and Design, J.D Anderson, McGrawhill Education, 2017
2. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2017.

REFERENCE BOOKS:

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley and Son:, Inc, NY, 1988.
2. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, NY, 1982.
3. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
4. Michael V. Cook, "Flight Dynamics Principles", Second Edition, Elsevier Aerospace Engineering Series, 2007.
5. Mc Cornick B. W, "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1995.

B.Tech. (VI Sem.)	23AE17– COMPUTATIONAL FLUID DYNAMICS AND HEAT TRANSFER	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Numerical Methods, Engineering Fluid Mechanics, Aerodynamics

Course Educational Objectives: To learn the basic governing equations of fluid dynamics, mathematical behaviour of partial differential equations, phenomena of various discretization techniques, techniques to solve the simple incompressible and heat transfer problems

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

COs	Statements	Blooms Level
CO1:	Formulate the governing equations of fluid dynamics	Apply
CO2:	Apply the discretization techniques to governing equations of fluid dynamics	Apply
CO3:	Understand various CFD techniques	Understand
CO4:	Solve elementary incompressible fluid problems using the CFD techniques	Apply
CO5:	Solve the elementary heat transfer problems using the CFD techniques	Apply

UNIT - I

INTRODUCTION

Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics.

GOVERNING EQUATIONS OF FLUID DYNAMICS: Introduction, Control Volume, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation, Conservation and Non-conservation forms of governing flow equations.

UNIT – II

MATHEMATICAL BEHAVIOR OF PARTIAL DIFFERENTIAL EQUATIONS: Introduction, Classification of Quasi-Linear Partial Differential Equations, Eigen Value Method, Hyperbolic Equations, Parabolic Equations, Elliptic Equations.

BASICS ASPECTS OF DISCRETIZATION

Introduction, Introduction of Finite Differences, Central- Forward- and Backward- Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation

UNIT – III

SIMPLE CFD TECHNIQUES: Introduction, Lax-Wendroff Technique, Maccormack's Techniques, Space Marching, Relaxation Technique and its use with low-speed inviscid Flow, Artificial Viscosity.

UNIT – IV

INCOMPRESSIBLE COUETTE FLOW: Introduction, The Physical Problem and its exact Analytical Solution, Implicit Crank-Nicholson Technique, Pressure Correction Method

UNIT – V

HEAT TRANSFER

Introduction, Finite Difference Applications in Heat conduction, 1D and 2D-steady state heat conduction in a rectangular geometry, 1D and 2D transient heat conduction, Finite difference application in convective heat transfer.

REFERENCE BOOKS:

1. Anderson.J.D, Computational Fluid Dynamics-Basics with Applications, Mc Graw Hill, 2017.
2. Anderson, D. A, Tannehill. J. C, Pletcher. R. H, Computational Fluid Mechanics and Heat Transfer, CRC Press, 2012.
3. Patankar. S. V, Numerical Heat Transfer and Fluid Flow, CRC Press, 1980.
4. Sengupta. T. K, Fundamentals of Computational Fluid Dynamics, University Press, 2004.
5. Ghoshdastidar P.S. Heat Transfer, Oxford University Press, 2012

B.Tech. (VI Sem.)	23AE18-AIR TRAFFIC SERVICES AND AERODROME DESIGN	L	T	P	Cr.
		3	0	0	3

Pre-requisites: Introduction to Aerospace Engineering

Course Educational Objectives: To provide students with foundational and operational knowledge of ATS, airspace management, and aerodrome facilities in alignment with ICAO standards.

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

COs	Statements	Blooms Level
CO1	Acquire the concept of air traffic rules, classifications, and clearance procedures for airline operation.	Understand
CO2	Understand the various air traffic data used in air traffic services.	Understand
CO3	Understand the influence of aerodrome design factors on airport operations.	Understand
CO4	Understand the navigation and emergency services	Understand

UNIT I

BASIC CONCEPTS: Objectives of ATS, scope and provision of ATC services, classification of ATS airspaces, separation methods, VFR/IFR operations, flexible use of airspace (FUA), controlled vs. uncontrolled airspace, altimeter setting procedures, ATS unit responsibilities.

UNIT II

AIR TRAFFIC SERVICES: ATS components: Area Control, Approach Control, Tower services; assignment of cruising levels, RNAV/RNP principles, ATC clearances, flight plans, position reporting, separation minima (longitudinal, vertical, lateral), FIR and SAR operations.

UNIT III

FLIGHT INFORMATION AND RADAR SERVICES: Flight Information and Alerting Services, emergency handling, basic radar principles, SSR, ADS-B, and MLAT, radar identification- using primary - secondary radar, coordination between radar and non-radar services, integration with ATFM.

UNIT IV

AERODROME DATA AND LAYOUT: Aerodrome reference code, layout, reference point, elevations, temperatures, runway classifications, physical characteristics: length of primary and secondary runways, width of runways, minimum distance between parallel runways, RESA, taxiway and apron design, obstacle restriction, comparison between domestic and international standards, heliport layout basics.

UNIT V

VISUAL AIDS FOR NAVIGATION AND EMERGENCY SERVICES: Visual aids for navigation, wind direction indicator, landing direction indicator, location and characteristics of signal area, markings, lights, Visual aids-VASI, PAPI-beacon systems, runway/taxiway lighting, obstacle lighting, emergency lighting, firefighting and rescue services, airport emergency procedures.

REFERENCE BOOKS:

1. Bali, Wg. Cdr. R. K. (Retd.), Air Regulations and Human Factors, 16th Updated Edition (2024).
2. Bali, Wg. Cdr. R. K. (Retd.), Air Navigation (6th Revised Edition, 2024).
3. Ashford, Norman J., Wright, Paul H., and Mumayiz, Saleh, Airport Engineering: Planning, Design, and Development, 4th Edition.
4. ICAO- Part I (Runways), 4th Edition (2020).
5. ICAO-Part II (Taxiways and Aprons), 5th Edition (2020).

B.Tech. (VI Sem.) **23AE19- NON-DESTRUCTIVE TESTING**

L	T	P	Cr.
3	0	0	3

Pre-requisites: Physics, Manufacturing Technology

Course Educational Objectives: To impart knowledge about the non-destructive testing (NDT) methods and selection of NDT methods based on components and its application in engineering industries.

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

COs	Statements	Blooms Level
CO1:	Describe the working principles of non-destructive techniques and standard sample specifications	Understand
CO2:	Identify suitable non-destructive techniques to detect defects in any component	Understand
CO3:	Describe the various safety measures while performing inspections	Understand
CO4:	Apply special techniques to detect the defects in any component	Apply

UNIT I

SURFACE TECHNIQUES: Introduction to Non-Destructive Testing - Importance of NDT Techniques - Types of NDT Techniques - ASME, ASTM, AWS, BIS, SAE Standard Sample Specifications, Visual Testing (Direct and Remote Visual Inspection) - Principle and Types of Liquid Penetrant Tests (LPT) - Properties of Liquid Penetrants and Developers - Advantages and Limitations of LPT - Applications of LPT.

UNIT II

MAGNETIC PARTICLE TESTING: Introduction to Magnetic Particle Testing (MPT) - Magnetization Methods - Dry Particle and Wet Fluorescent Particle Techniques - Demagnetization - Advantages and Limitations of MPT, Magnetic Flux Leakage Testing - Principle, Instrumentation and Applications of Electromagnetic Induction Techniques and Eddy Current Testing (ECT) Method.

UNIT III

ULTRASONIC TESTING: Introduction to Ultrasonic Testing (UT) - Characteristics of Ultrasonic Waves - Principle of UT – UT Probes - UT Inspection Methods (Pulse Echo, Transmission and Phased Array Techniques, PAUT) -Types of Scanning and Displays - Application of UT for Welded Parts.

UNIT IV

RADIOGRAPHY TESTING: Introduction to Radiography Testing (RT) - Sources of X-Rays and Gamma Rays - Characteristics of X-rays and Gamma Rays (Absorption, Scattering) - Filters and Screens - Film Radiography and Digital Radiography (Shadow Formation, Exposure Factors, Film Handling and Storage) - Inverse Square Law - Exposure Charts - Penetrometers - Safety Issues.

UNIT V

SPECIAL TECHNIQUES: Acoustic Emission Testing (AET) Principle - Advantages, Limitations - Instrumentation and Application of AET, Infra-Red Thermography (IRT) - Contact and Non-Contact Inspection Methods - Pressure and Leak Detection, Laser Shearography, Acoustic Holography.

REFERENCE BOOKS:

1. Baldev Raj. Jayakumar. T, Thavasimuthu. M, Practical Non-Destructive Testing, NarosaPublishing, India, 2012.
2. ASM Metals Handbook, Volume-17, Non-Destructive Evaluation and Quality Control, AmericanSociety of Metals, Metals Park, Ohio, USA, 2001.
3. McGonnagle. W. T, Non-Destructive Testing, McGraw Hill Book Co., USA, 2013.
4. Cartz. L, Non-Destructive Testing, ASM International, Metals Park Ohio, US, 2007.

B.Tech. (VI Sem.) **23AE20- FLIGHT VEHICLE DESIGN**

L	T	P	Cr.
3	0	0	3

Pre-requisites: Aerodynamics, Aircraft Structures, Air breathing Propulsion

Course Educational Objectives: To learn engineering concepts of overall design of an Aircraft, its load characteristics, design of wings and fuselage, engine selection and flight vehicle performance, design of various flight subsystems and cost analysis of aircraft design and operation.

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

COs	Statements	Blooms Level
CO1	Understand the basic design process of an aircraft and perform the load analysis on the wings	Understand
CO2	Calculate the requirements for a fuselage and wings of an aircraft	Apply
CO3	Match the performance requirements of the aircraft with the appropriate engines	Apply
CO4	Understand the design aspects of various subsystems of an aircraft	Understand
CO5	Estimate approximate cost analysis of the entire lifecycle of the aircraft	Apply

UNIT I

INTRODUCTION : Overview of Design Process: Introduction, Requirements, Phases of design, Conceptual Design Process, Initial Sizing, Take-off weight build up, Empty weight estimation, Fuel fraction estimation, Take- off weight calculation.

Thrust to Weight Ratio and Wing Loading: Thrust to Weight Definitions, Statistical Estimate of T/W. Thrust matching, Wing Loading and its effect on Stall speed, Take-off Distance, Catapult take-off, and Landing Distance. Wing Loading for Cruise, Loiter, Endurance, Instantaneous Turn rate, Sustained Turn rate, Climb, Glide, Maximum ceiling.

UNIT II

WING AND FUSELAGE DESIGN: Configuration Layout and Loft: Introduction – End products of Configuration layout, Wing location with respect to the fuselage - Wing-Tail Layout and Loft - Aerofoil Linear Interpolation - Aerofoil Flat - wrap Interpolation. Wing aerofoil layout-flap wrap - Wetted area determination - Special considerations in Configuration Layout: Aerodynamic, Structural, Detectability. Crew station, Passenger and Payload arrangements.

Design of Structural Components: Fuselage, Wing, Horizontal and Vertical Tail. Tail arrangements, Horizontal and Vertical Tail Sizing. Tail Placement. Loads on Structure. V-n Diagram, Gust Envelope. Loads distribution, Shear and Bending Moment analysis.

UNIT III

ENGINE SELECTION AND FLIGHT VEHICLE PERFORMANCE: Propulsion selection – Number of Engines and Engine Ratings - Turbojet Engine Sizing: - Installed Thrust Correction, Engine Sizing - Propeller Propulsive System:- Propeller design for cruise - Take-off and Landing characteristics:- Ground Roll, Rotation, Transition, Climb, Balanced Field Length, Landing Approach, Braking, Spread Sheet for Take-off and Landing - Enhanced lift design :-Passive and Active.

UNIT IV

DESIGN ASPECTS OF SUBSYSTEMS: Flight Control system, Landing Gear and subsystem, Propulsion and Fuel System Integration, Air Pressurization and Air Conditioning System, Electrical and Avionic Systems, Structural loads, Safety constraints, Material selection criteria.

UNIT V

COST ANALYSIS: Introduction – Elements of Lifecycle cost – Cost Estimation Methods – RDTandE and Production costs – Operations and Maintenance Costs – Cost Measures of Merit (Military) – Airline Economics.

REFERENCE BOOKS:

1. Daniel P. Raymer, "Aircraft Design: A Conceptual Approach", AIAA Education Series 1992.
2. Tomas C Corke., "Design of Aircraft," Person Education, LPE, 2003,
3. John P Fielding, "Introduction to Aircraft Design" Cambridge University Press, 1999
4. Darrol Stinton D.," The Design of the Aeroplane", Black Well Science, 2nd Edition, 2001

B.Tech. (VI Sem.) **23AE21- HELICOPTER AERODYNAMICS**

L	T	P	Cr.
3	0	0	3

Pre-Requisites: Aerodynamics and Flight Dynamics

Course Educational Objectives: To learn the functions of various parts of helicopter, rotor theories and power requirements of helicopter motion, performance of helicopter in hovering and climbing, performance of horizontal and forward flight and control.

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

COs	Statements	Blooms Level
CO1	Understand the functions of various components of helicopter	Understand
CO2	Apply momentum theory in the design of propeller	Apply
CO3	Understand the performance of helicopter in various operating conditions	Understand
CO4	Understand the stability modes of helicopter	Understand

UNIT – I

BASICS OF HELICOPTER CONFIGURATION: Introduction, Configurations of Helicopter, Specifics of Helicopters, Articulated Rotor Systems, Effect of Cyclic Pitch Change, Swash Plate, Rotor Systems - Fully Articulated Rotor - Semi-Rigid rotor - Rigid Rotor - Coriolis effect, Methods of control.

UNIT – II

MOMENTUM THEORY: Introduction, Thrust Generation - Hovering - Figure of Merit, Blade Element Theory, General Expression for V_i - Local Solidity, Top Loss, Performance of ideally Twisted Constant Chord Blade, Rapid performance in Hover - Equivalent Chord.

UNIT – III

PERFORMANCE IN HOVERING AND CLIMBING: Introduction, Optimum Hovering Rotor, Induced Torque, Profile Drag Torque, Performance Equation - Optimum Rotor Design, Ground effect.

UNIT – IV

PERFORMANCE IN HORIZONTAL FLIGHT: Introduction, Flapping and lag Hinge, Steady Hover, Equilibrium in Horizontal Blade - Blade Hinge Motion, Blade Element Angle of Attack - Flapping Coefficient

FORWARD FLIGHT: Introduction to Forward Flight, Performance equation, Drag-Lift Ratio, Profile Drag-Lift Ratio Charts, Profile Power, Parasite Power, Blade Stall.

UNIT – V

STABILITY AND CONTROL: Introduction, Stability Terms - Trim - Static Stability - Dynamic Stability, Rotor Static Stability, Stability in Hover, Dynamic Stability, Dynamic Stability Reduction, Stability in Forward Flight

REFERENCE BOOKS:

1. E. Rathakrishnan., Helicopter Aerodynamics, Prentice Hall of India Pvt. Ltd, New Delhi, 2019.
2. Gessow, A., Myers, Aerodynamics of Helicopter, Continuum International Publishing Group Ltd. 1997
3. B. W. McCormick, Aerodynamics of V/STOL Flight, Dover Publications, 1999.
4. W. Johnson, Helicopter Theory, Dover Publications Inc.; Revised edition 2003
5. B. W. McCormick, Aerodynamics, Aeronautics and Flight Mechanics, John Wiley, 1995.

B.Tech. (VI Sem.) **23AE22- EXPERIMENTAL STRESS ANALYSIS**

L	T	P	Cr.
3	0	0	3

Pre-Requisites: Solid Mechanics

Course Educational Objectives: To understand the stress transformation, various method such as strain gauges, Moire method, photoelasticity and birefringent coatings to measure the strain.

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

COs	Statements	Blooms Level
CO1:	Formulate equations of stress under equilibrium conditions	Apply
CO2:	Apply the strain gage system for strain measurement on bodies acted upon forces	Apply
CO3:	Apply and analyze the moiré fringe method in a stress field	Apply
CO4:	Analyze the fringe pattern of materials using polariscope	Analyze

UNIT - I

STRESS: Stress - Stress Equations of Equilibrium - Laws of Stress Transformation - Principal Stresses – Maximum Shear Stress - Dimensional State of Stress.

UNIT - II

STRAIN MEASUREMENT: Strain - Experimental Determination, Strain Gauges – Properties of Strain Gauge Systems - Electrical Resistance Strain Gauges - Strain Gauge Circuits, Recording Instruments, Analysis of Strain Gauge Data.

UNIT - III

MOIRE METHODS: Mechanism of Formation of Moire Fringe - Geometrical Approach to Moire Fringe Analysis - Displacement Field Approach to Moire Fringe Analysis - Out of Plane Measurements Experimental Procedure.

UNIT - IV

PHOTO ELASTICITY METHODS: Temporary Double Refraction, Stress Optic Law, - Effects of Stressed Model inPlane Polariscope Fringe Multiplication - Isochromatic Fringe Patterns - Isoclinic Fringe Pattern Compensation Techniques, Calibration Methods, Separation Methods, Scaling Model to Prototype Stresses - Materials.

UNIT - V

BIREFRINGENT COATINGS: Coating Stresses and Strains - Sensitivity - Materials and Applications - Effect of Thickness - Stress Separation.

REFERENCE BOOKS:

1. J Srinivas, Stress Analysis and Experimental Techniques: An Introduction, Narosa Publishing House, New Delhi, 2012.
2. Dally, J. W., Riley, W. F. Experimental Stress Analysis, Third Edition, McGraw-Hill, 1991.
3. Dove, R. C., Adams, P. H. Experimental Stress Analysis and Motion Measurement: Theory, Instruments and Circuit, Techniques. Prentice-Hall of India, New Delhi, 1965.
4. Perry, C. C., Lissner, H. R. The Strain Gauge Primer, Second Edition, McGraw Hill, 192.
5. Durelli, A. J., Riley, W. F. Introduction to Photomechanics, Prentice Hall, 1965.
6. Sadhu Singh. Experimental Stress Analysis, Fourth Edition, Khanna Publisher, New Delhi, 2009.

B.Tech. (VI Sem.)	23AE23- INSTRUMENTATION MEASUREMENTS AND EXPERIMENTS IN FLUIDS	L	T	P	Cr.
		3	0	0	3

Pre-Requisites: Engineering Fluids Mechanics, Thermodynamics

Course Educational Objectives: To learn the need of experimentation and wind tunnel techniques, theory of flow visualization techniques and analogue methods, working principle of various velocity measurement instruments, working of various pressure and temperature measurement instruments, and principle data acquisition and uncertainty estimation of measured data.

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

COs	Statements	Blooms Level
CO1	Employ the wind tunnels for aerodynamic testing of bodies	Apply
CO2	Adopt and use a visualization technique to understand the flow field	Apply
CO3	Employ the suitable instrument to measure the velocity, temperature and pressure of fluid flow	Apply
CO4	Acquire experimental data and to estimate the uncertainty in measured values during experimentation	Apply

UNIT - I

NEED AND OBJECTIVE OF EXPERIMENTAL STUDY: Introduction, Measurement Systems, Performance Terms.

WIND TUNNELS: Introduction, Classification, Low-speed Wind Tunnels, Power Losses in Wind Tunnel, Energy Ratio, High-speed Wind Tunnels, Instrumentation and Calibration of Wind Tunnels, Wind Tunnel Balance-Wire Balance, Strut-Type, Platform Type, Yoke Type, Strain-Gauge Balance, Balance Calibration.

UNIT - II

FLOW VISUALIZATION AND ANALOG METHODS: Introduction, Classification of Visualization Techniques, Smoke Tunnel, Interferometer, Schlieren and Shadowgraph, Hele-Shaw Apparatus, Electrolytic Tank, Hydraulic Analogy, Hydraulic Jumps.

UNIT - III

VELOCITY MEASUREMENT: Introduction, Velocity and Mach number from pressure measurements, Laser droplet anemometer, PIV, Measurement of velocity by Hot-Wire Anemometer, Hot-Wire Probes, Limitations of Hot-Wire Anemometer, Measurement of velocity using vortex shedding Technique, Fluid Jet Anemometer

UNIT - IV

PRESSURE MEASUREMENT TECHNIQUES: Introduction, Barometers, Manometers, Dial type pressure gauge, Pressure Transducers, Pitot, Static, and Pitot-Static Tube and Its characteristics, Flow direction measurement probes and Low Pressure Measurement Gauges.

TEMPERATURE MEASUREMENT: Introduction, Types of thermometers, Thermocouples, RTD, Thermistors, Pyrometers, Temperature measurement in fluid flows.

UNIT - V

DATA ACQUISITION: Introduction, Data Acquisition Principle, Generation of Signal, Signal Conditioning, Multiplexing, Data Conversion, Data Storage and Display, Data Processing, Digital Interfacing, Data Acquisition using Personal Computers.

UNCERTAINTY ANALYSIS: Introduction, Estimation of measurement errors, External estimation of errors, Internal estimate of the error, Uncertainty Analysis- Uses of uncertainty analysis, Uncertainty estimation, General procedure- Uncertainty in flow Mach number, Uncertainty calculation.

REFERENCE BOOKS:

1. E. Rathakrishnan, Instrumentation, Measurements and Experiments in Fluids, CRC press, CRC Press; 2nd edition, 2020
2. Jack Philip Holman, Experimental methods for Engineers, McGraw Hill Education; 7th edition, 2017.
3. Jewel B. Barlow, William H. Rae, Alan Pope., Low Speed Wind Tunnel Testing, Wiley India Pvt Ltd; Third edition, 2010.
4. Pope, A., Goin, L., High Speed Wind Tunnel Testing, John Wiley, 1985.
5. Ernest Doebelin, Measurement Systems, McGraw Hill Education; 6th edition, 2017
6. John H. Lienhard V Thomas G. Beckwith, Roy D. Marangoni, Mechanical Measurements, Pearson Education; Revised 6e edition, 2020

B.Tech. (VI Sem.) 23AE24- INTRODUCTION TO SMART STRUCTURES

L	T	P	Cr.
3	0	0	3

Pre requisition: Materials and Metallurgical science, Composite materials

Course Educational Objective: The objective of this course is to provide the basic knowledge on different types and structure of smart alloys as well as the techniques used to functionalize common materials.

COURSE OUTCOMES: By the end of the course students will be able to

COs	Statements	Blooms Level
CO1:	Understand the behavior of smart materials	Understand
CO2:	Identity various types of smart materials for Aerospace vehicles	Understand
CO3:	Understand properties of shape memory alloy smart materials	Understand
CO4:	Identity advanced smart materials for various applications	Understand

UNIT I

INTRODUCTION AND HISTORICAL PERSPECTIVE: Overview of Intelligent /Smart materials – Functional materials – Poly functional materials - Generation of smart materials, Diverse areas of intelligent materials – Primitive functions of intelligent materials – Intelligent inherent in materials – Examples of intelligent materials, structural materials – Technological applications of Intelligent materials in aerospace.

UNIT II

SMART MATERIALS AND PROPERTIES: The principal ingredients of smart materials - Sensing technologies – Micro sensors – Hybrid smart materials – Optical properties (optical bandgap engineering, nonlinear optical effects) - Electrical properties (piezoelectric effect). Thermo-mechanical properties (shape memory and phase change alloys) - Magnetic properties (magnetoresistance and magnetostrictive effect).

UNIT III

SMART ACTUATORS AND COMPOSITE MATERIALS: Piezoelectric materials – Properties of commercial piezoelectric materials –Piezoelectric sensors and actuators – Smart materials featuring piezoelectric elements – Review of Composite Materials, Micro and Macro-mechanics, Integration of Smart Sensors and Actuators to Smart Structures – Active Fibre Composites (AFC)- failure criteria for composites; aircraft applications and related design issues

UNIT IV

SHAPE – MEMORY (ALLOYS) SMART MATERIALS: Background on shape memory alloys (SMA) - Nickel – Titanium alloy (Nitinol) – Materials characteristics of Nitinol – phase transformations – Cu based SMA, chiral materials – Applications of SMA – SMA fibers – reaction vessels, nuclear reactors, chemical plants, etc. – Micro robot actuated by SMA – SMA memorisation process (Satellite antenna applications).

UNIT V

ADVANCES IN SMART STRUCTURES AND MATERIALS: Self-Sensing Piezoelectric Transducers, Energy Harvesting Materials, Autophagous Materials, Self- Healing Polymers, Intelligent System Design, Emergent System Design, Selected applications of smart structures in aircraft design.

REFERENCE BOOKS:

1. M.V.Gandhi and B.S. Thompson, Smart Materials and Structures Chapman and Hall, London, First Edition, 1992
2. T.W. Deurig, K.N.Melton, D.Stockel and C.M.Wayman, Engineering aspects of Shape Memory alloys, Butterworth –Heinemann, 1990
3. C.A.Rogers, Smart Materials, Structures and Mathematical issues, TechnomicPublising Co., USA, 1989.

B.Tech. (VI Sem.)	23AE57- AIRCRAFT STRUCTURES LAB	L	T	P	Cr.
		0	0	3	1.5

Course Educational Objectives: To experimentally study fundamental structural concepts applied in aircraft structures and to validate classical structural theorems and principles using hands-on experiments. To introduce non-destructive testing (NDT) techniques and composite material testing.

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

COs	Statements	Blooms Level
CO1:	Analyze the structural behavior of beams under different loading conditions	Analyze
CO2:	Evaluate deflections and internal stresses of various members using theoretical and experimental methods.	Analyze
CO3:	Examine and interpret results from Non-Destructive Testing (NDT) methods to assess surface and sub-surface defects in structural components	Analyze

List of Experiments:

(Any 10 out of the following may be conducted):

1. Verification of Maxwell's Reciprocal Theorem
2. Verification of Castigliano's Theorem
3. Non-Destructive Testing (NDT): Dye Penetration Test and Magnetic Particle Detection
4. Determination of Beam Deflection for various sections
5. Compression Test on Columns
6. Wagner Beam (Tension Field Beam) – Shear load distribution
7. Determination of Shear Centre for Open and Closed sections
8. Determination of Principles Stresses and Strains
9. Determination of Bending Modulus for a Sandwich Beam
10. Unsymmetrical Bending of Cantilever Beams of various section
11. Shear Failure Test on Bolted and Riveted Joints
12. Forced Vibration Testing of Beams – Natural frequency and damping
13. Preparation Composite Laminate
14. Bending Test of Composite Laminate

B.Tech. (VI Sem.)	23AE58- PROPULSION LAB	L	T	P	Cr.
		0	0	3	1.5

Course Educational Objectives: To learn the various basic experiments related to components of jet engines and piston engines.

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

COs	Statements	Blooms Level
CO1:	Estimate the performance parameters of various jet engine components	Apply
CO2:	Characterize the wall and free jet	Apply
CO3:	Prepare various solid propellent grains	Apply

Any of the 10 Experiments are required to be conducted

1. Free jet characteristics
2. Wall jet characteristics
3. Free convective heat transfer rate over an airfoil
4. Forced convective heat transfer rate over an airfoil
5. Cascade testing of compressor blade row
6. Cascade testing of turbine blade row
7. Performance characteristics of three stage axial flow compressor
8. Measurement of burning velocity of pre-mixed flame
9. Performance evaluation of thrust produced by propeller (constant pitch and variable pitch) at various speeds
10. Flow through subsonic inlet
11. Preparation of solid propellant grains
12. Study of Properties of aviation fuel
13. Spray studies on various liquid propellants
14. Spray characteristics of gel propellants

B.Tech. (VI Sem.)

23HSS1-- SOFT SKILLS

L	T	P	Cr.
0	1	2	2

Course Objectives:

- To equip the students with the skills to effectively communicate in English
- To train the students in interview skills, group discussions and presentation skills
- To motivate the students to develop confidence
- To enhance the students' interpersonal skills
- To improve the students' writing skills

UNIT – I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.
Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT – II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities
Etiquette: Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

UNIT – III

Standard Operation Methods : Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking, Minutes Preparation, Email & Letter Writing

UNIT-IV

Job-Oriented Skills: Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V

Interpersonal relationships: Introduction, Importance, Types, Uses, Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

TEXT BOOKS:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
2. S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.

REFERENCE BOOKS:

1. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018.
2. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.

E-resources:

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01