GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY

Unit of USHODAYA EDUCATIONAL SOCIETY

An ISO 9001:2015 certified Institution: Recognized under Sec. 2(f)& 12(B) of UGC Act, 1956

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

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DEPARTMENT OF MECHANICAL ENGINEERING

Vision

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

Mission

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

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

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

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

Program Educational Outcomes

PEO1: Examine and Analyze Mechanical Engineering problems and provide sustainable solutions.

PEO2: Pursue successful professional career in industry, academia or research.

PEO3: Engage in continuous learning to keep abreast with emerging technologies with the sense of professional ethics.

PEO4: Contribute in multi-disciplinary teams through effective interpersonal skills

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

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

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

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

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

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

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

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

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

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

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

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

Program Specific Outcomes

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

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

S.No.	Course Code	category	Course Name	L	T	P	Credits
			Semester–II				
1.	23A0009T	BS&H	Communicative English	2	0	0	2
2.	23A0005T	BS&H	Chemistry	3	0	0	3
3.	23A0002T	BS&H	Differential Equations and Vector calculus	3	0	0	3
4.	23A0101T	Engineering science	Basic Civil & Mechanical Engineering	3	0	0	3
5.	23A0303T	Engineering science	Engineering Mechanics	3	0	0	3
6.	23A0010P	BS&H	Communicative English Lab	0	0	2	1
7.	23A0008P	BS&H	Chemistry Lab	0	0	3	1.5
8.	23A0302P	Engineering science	Engineering Workshop	0	0	3	1.5
9.	23A0304P	Engineering science	Engineering Mechanics Lab	0	0	3	1.5
10.		BS&H	Health and Wellness, Yoga and Sports	-	-	1	0.5
			Total	14	0	11	20

Category	Credits
Basic Science & Humanities Course (BSHC)	11
Engineering Science Course (ESC)	9
Total	20

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COMMUNICATIVE ENGLISH					
(Common to all Branches of Engineering)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
230009T	**2: 0: 0: 0**	**2**	**CIE:30 SEE:70**	**3 Hours**	**BSH**

Course Objectives:

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

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

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text Scanning to look for specific pieces of information.
Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.
Grammar: Parts of Speech, Basic Sentence Structures-forming questions
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

Module – II	**The Brook by Alfred Tennyson (Poem)**	**7Hrs**

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks**.**
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions.
Vocabulary: Homonyms, Homophones, Homographs.

Module – III	**BIOGRAPHY: Elon Musk**	**6 Hrs**

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

Module - IV	**INSPIRATION: The Toys of Peace -Saki**	**6 Hrs**

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

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

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data

Writing: Letter Writing: Official Letters, Resumes

Grammar : Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

Module - V	MOTIVATION: The Power of Intrapersonal Communication (An Essay)	5 Hrs

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

Speaking: Formal oral presentations on topics from academic contexts

Reading: Reading for Comprehension

Writing: Writing structured essays on specific topics**.**

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

Vocabulary: Technical Jargons

Course Outcomes(CO):

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

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

Reference Books:
1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web References:
GRAMMAR:
1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx
VOCABULARY
1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

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CHEMISTRY
(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0005T	3:0:0:0	3	CIE: 30 SEE:70	3 Hours	BSH

Course Objectives:

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

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

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and $\Psi2$, Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and $\Psi2$, particle in one dimensional box, molecular orbital theory – bonding in homo- and hetero-nuclear diatomic molecules – energy level diagrams of O_2, CO, and NO. π-molecular orbitals of butadiene and benzene, calculation of bond order.

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

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

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

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

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

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

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

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

Course Outcomes(CO):

On completion of this course, student will be able to

- Describe Planck's quantum theory, dual nature of matter, Schrodinger equation, molecular orbital Theory and molecular orbital energy level diagram of differentmolecules
- Explain Crystal field theory, splitting in octahedral and tetrahedral geometry and themagnetic behavior, Oxidation state, coordination and color of complexes.

- Explain the principle of Band diagrams of conductors, superconductor, semiconductorsand insulator and nonmaterial
- Discuss the principles of electrochemistry in potentiometry, conductometry, battery and electrochemical sensors
- Explain polymerization and the preparation, properties, and applications of thermoplastics &thermosetting, elastomers, & conducting polymers
- Discuss the different applications of analytical instruments

Text Books:
1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.

Reference Books:
1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. J.M.Lehn, Supra Molecular Chemistry, VCH Publications

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DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0002T	3:0:0:0	3	CIE:30 SEE:70	3 Hours	BSH

Course Objectives:

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

Syllabus		Total Hours:45
Unit-I	**Differential equations of first order and first degree**	**9Hrs**
Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decayElectrical circuits.		
Unit-II	**Linear differential equations of higher order (Constant Coefficients)**	**9Hrs**
Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.		
Unit-III	**Partial Differential Equations**	**9Hrs**
Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.		
Unit-IV	**Vector differentiation**	**9Hrs**
Scalar and vector point functions, vector operator Del, Del applies to scalar point functions-Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.		
Unit-V	**Vector integration**	**9Hrs**
Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems		

Course Outcomes(CO):

On completion of this course, student will be able to

CO1: Solve the first order differential equations related to various engineering fields.

CO2: Solve the linear differential equations of higher order with constant coefficients

CO3: Identifysolutionmethodsforpartialdifferentialequationsthatmodelphysical processes.

CO4: Interpret the physical meaning of different operators such as gradient, curland divergence.

CO5: Apply Green's, Stokes and Divergence theorem in work done, circulation, flux and triple integrals.

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

Reference Books:
1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017
6. Engineering Mathematics I by T.K.V. Iyengar, B.Krishna Gandhi,, S. Chand Publications, 2015 Edition.

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BasicCivil & Mechanical Engineering						
CourseCode	**L:T:P**	**Credits**	**Exam.Marks**	**ExamDuration**	**REG**	**CourseType**
23A0101T	**3:0:0**	3	CIE:30 SEE:70	3Hours	RG23	ESC

CourseObjectives:

- GetfamiliarizedwiththescopeandimportanceofCivilEngineeringsub-divisions
- Introducethe preliminaryconceptsofsurveying.
- AcquirepreliminaryknowledgeonTransportationanditsimportanceinnation'seconomy.
- Getfamiliarizedwiththeimportanceofquality,conveyanceandstorageofwater
- Introductiontobasiccivilengineeringmaterialsandconstructiontechniques

Syllabus	PART-A	TotalHours:48
Unit–I		9

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

Unit–II		10

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

Unit–III		9

TransportationEngineeringImportanceofTransportationinNation'seconomicdevelopment- Types of Highway Pavements- Flexible Pavements and Rigid Pavements-SimpleDifferences.BasicsofHarbour,Tunnel,Airport,and RailwayEngineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Qualityof water-Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage andConveyance Structures(SimpleintroductiontoDamsandReservoirs)

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

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

UNIT II		10

Manufacturing Processes: Principles of Casting, Forming, joining processes, Machining,

Introduction to CNC machines, 3D printing, and Smart manufacturing.

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

UNIT III		10

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

Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications. Introduction to Robotics - Joints & links, configurations, and applications of robotics.

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

Textbooks:

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

2.　　A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.

3.　　An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, cengage learning India pvt. Ltd

ReferenceBooks:

1.　Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I

2.　3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications

3.　Thermal Engineering by Mahesh M Rathore Tata Mcgraw Hill publications (India) Pvt. Ltd.

4.　 G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata Mcgraw Hill publications (India) Pvt. Ltd.

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ENGINEERING MECHANICS						
(Common to All branches of Engineering)						
Course Code	**L T P/D C**	**Credits**	**Exam marks**	**Exam Duration**		**Course Type**
23A0301	1 0 4 3	3	**CIE:30 & SEE:70**	3 Hours		PCC

Course Objectives:

The students completing the course are expected to:
- To get familiarized with different types of force systems.

- To draw accurate free body diagrams representing forces and moments acting on 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.

Unit-I		**10Hrs**

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

Unit-II		**12Hrs**

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

Unit -III		**12Hrs**

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite figures
Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems.
Area Moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.
Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies**.**

Unit -IV		12Hrs

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

Unit -V		12Hrs

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

Course Outcomes(CO):

On completion of the course, the student should be able to:
- Understand the fundamental concepts in mechanics and determine the frictionalforces for bodies in contact.
- Analyze different force systems such as concurrent, coplanar and spatial systemsand calculate their resultant forces and moments.
- Calculate the centroids, center of gravity and moment of inertia of differentgeometrical shapes.
- Apply the principles of work-energy and impulse-momentum to solve the problemsof rectilinear and curvilinear motion of a particle.

Solve the problems involving the translational and rotational motion of rigid bodies

Textbooks:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5thEdition, McGraw Hill Education,2017.

2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition,Pearson Education, Inc., New Delhi, 2022

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGrawHill Education,2017.

2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., 4th Edition, PHI,2002.

3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. MeriamandL. G. Kraige., 6th Edition, John Wiley, 2008.

4. Engineering Mechanics: Principles of Statics and Dynamics, R.C. Hibbler., PearsonPress, 2006.

5. Introduction to Statics and Dynamics, Andy Ruina and Rudra Pratap., OxfordUniversity Press, 2011.

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COMMUNICATIVE ENGLISH LAB
(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
2300010P	0:0:2:0	1	CIE:30 SEE:70	3 Hours	BSH

Course Objectives:

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

List of Experiments	Total Hours:32

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

Course Outcomes(CO):

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

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

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

Voice & Accent:

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

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3rd Mile, Bombay Highway, Gangavaram (V), Kovur(M), SPSR Nellore (Dt), Andhra Pradesh, India- 524137
Ph. No. 08622-212769, E-Mail: geethanjali@gist.edu.in, Website: www.gist.edu.in

CHEMISTRY LAB
(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0007P	**0: 0: 2:0**	**1**	**CIE:30 SEE:70**	**3 Hours**	**BSH**

Course Objectives:

- Verify the fundamental concepts with experiments

List of Experiments	Total Hours:48

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery

7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Simultaneous estimation of Mn and Cr ions by spectrophotometry in water samples.
10. Wavelength measurement of sample through UV-Visible Spectroscopy
11. Identification of functional groups in organic compounds by IR Spectroscopy.
12. Preparation of nanomaterials by precipitation method
13. Estimation of Ferrous Iron by Dichrometry
14. Determination of Hardness of a groundwater sample
15. pH metric titration of strong acid vs strong base

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

Course Outcomes(CO):

On completion of this course, student will be able to

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

Text Books:

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

Reference Books:

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

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ENGINEERING WORKSHOP
(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0302P	0: 0: 3: 0	1.5	CIE:30 SEE:70	3 Hours	BSH

Course Objectives:

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

Syllabus	Total Hours:32

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

Course Outcomes(CO):

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

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

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

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ENGINEERING MECHANICS LAB

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
23A0304P	0:0:2:0	1	CIE:30 SEE:70	3 Hours	BSC

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

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

Syllabus	Total Hours: 48
List of Experiments	

1. Verification of Law of Parallelogram ofForces.
2. Verification of Law of Triangle ofForces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal forcetable.
4. Determination of coefficient of Static and RollingFrictions
5. Determination of Centre of Gravity of different shaped PlaneLamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam
7. Study of the systems of pulleys and draw the free body diagram of thesystem.
8. Determine the acceleration due to gravity using a compoundpendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre ofmass.
10. Determine the Moment of Inertia of aFlywheel.
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, 5thEdition, McGraw HillEducation,2017.

2.   Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14thEdition,Pearson
   Education, Inc., New Delhi, 2022.

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NELLORE–524317 (A.P) INDIA

B.TECH IN MECHANICAL ENGINEERING
COURSE STRUCTURE AND SYLLABI (2nd Year)
UNDER B Tech ME- RG 23 REGULATIONS

DEPARTMENT OF MECHANICAL ENGINEERING

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

Category	Credits
Basic Science & Humanities Course (BS&H)	6
Engineering Science Course (ES)	4.5
Professional Core Course (PC)	7.5
Skill Enhancement Course (SEC)	2
Audit Course (AC)	0
Total	20

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II Year B.Tech. ME – III Semester

<table>
<tr><td colspan="6" align="center">**Transform and Numerical Methods**</td></tr>
<tr><td>**Course Code**</td><td>**L:T:P:S**</td><td>**Credits**</td><td>**Exam Marks**</td><td>**Exam Duration**</td><td>**Course Type**</td></tr>
<tr><td>**23A0013T**</td><td>**3:0:0:0**</td><td>**3**</td><td>**CIE:30 SEE:70**</td><td>**3Hours**</td><td>**BS & H**</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="4">**Syllabus**</td><td colspan="2">**TotalHours:45**</td></tr>
<tr><td>**Unit-I**</td><td colspan="4">**Solution of Algebraic & Transcendental Equations and Interpolation**</td><td>**9Hrs**</td></tr>
<tr><td colspan="6">Introduction-Bisection Method, Regula-falsi method and Newton Raphson method Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.</td></tr>
<tr><td>**Unit-II**</td><td colspan="4">**Solution of Initial value problems to Ordinary differential equations**</td><td>**9Hrs**</td></tr>
<tr><td colspan="6">Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods-Runge-Kutta methods (second and fourth order).</td></tr>
<tr><td>**Unit-III**</td><td colspan="4">**Laplace Transforms**</td><td>**9Hrs**</td></tr>
<tr><td colspan="6">Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, transforms of derivatives and integrals – Unit step function – Second shifting theorem– Convolution theorem. Applications of LT to Differential Equations</td></tr>
<tr><td>**Unit-IV**</td><td colspan="4">**Fourier series**</td><td>**9Hrs**</td></tr>
<tr><td colspan="6">Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions.</td></tr>
<tr><td>**Unit- V**</td><td colspan="4">**Fourier transforms**</td><td>**9Hrs**</td></tr>
<tr><td colspan="6">Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem. Finite Fourier Sine & Cosine transform.</td></tr>
<tr><td colspan="6">**Course Outcomes:** After successful completion of this course, the students should be able to:
CO1. Apply numerical methods to solve algebraic and transcendental equations, form the interpolating Polynomials and fitting of curve.
CO2. Solve the differential equations numerically
CO3. Understand the concept of Laplace Transforms, find the Laplace Transforms of different functions and apply Laplace Transforms to solve the Differential Equations.
CO4. Solve the Fourier Series expression for the different periodic functions.
CO5. Solve Fourier Sine and Cosine integrals. Understand Fourier Transforms. Apply properties of Fourier transforms</td></tr>
</table>

Textbooks:

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

Reference Books:

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

Online Learning Resources:

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

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – III Semester

Universal Human Values– Understanding Harmony & Ethical human conduct					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0021T	**2:1:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BS & H**

Course Objectives:

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

Syllabus		**Total Hours:30**
Unit-I	**INTRODUCTION TO VALUE EDUCATION**	**6 Hrs**

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

Unit-II	**HARMONY IN THE HUMAN BEING**	**6 Hrs**

Understanding Human being as the Co-existence of the self and the body, Distinguishing between the Needs of the self and the body, Exploring the difference of Needs of self and body., The body as an Instrument of the self, Understanding Harmony in the self, Exploring Sources of Imagination in the self, Harmony of the self with the body, Programme to ensure self-regulation and Health, Exploring Harmony of self with the body
Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Unit-III	**HARMONY IN THE FAMILY AND SOCIETY**	**6 Hrs**

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

Practice Sessions for

UNIT III – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Unit-IV	**HARMONY IN THE NATURE/EXISTENCE**	**6 Hrs**

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

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

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

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

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

Course Outcomes(CO):

On completion of this course, student will be able to

 CO1. Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)

 CO2. Identify one's self, and one's surroundings (family, society nature) (L1, L2)

 CO3. Apply what they have learnt to their own self in different day-to-day settings in real life (L3)

 CO4. Relate human values with human relationship and human society. (L4)

 CO5. Justify the need for universal human values and harmonious existence (L5)

 CO6. Develop as socially and ecologically responsible engineers (L3, L6)

Textbooks:

1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria,Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal

9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Online Resources:

1. https://fdp-si.aicte-india.org/UHV- II%20Class%20Notes%20&%20Handouts/ UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/ UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/ UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/ UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20 Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview.

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DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. ME – III Semester

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

Course Objectives:

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

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

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

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

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

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

Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance. Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase. Elementary Treatment of the Third Law of Thermodynamics, Availability and Irreversibility- Causes of Irreversibility -Exergy concept –T ds equations - Gibbs and Helmholtz Functions, Maxwell Relations .

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

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

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

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

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

Course Outcomes(CO):

CO1. Explain the importance of thermodynamic properties related to conversion of heat energy into work.

CO2. Understand Second Law of Thermodynamics.

CO3. Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, Phase Transformations.

CO4. Evaluate the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads.

CO5. Evaluate the COP of refrigerating systems and properties, processes of psychrometry and sensible and latent heat loads.

Text Books:

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.

2. Y.A.Cengel & M.A.Boles ,Thermodynamics – An Engineering Approach, 7/e, McGraw Hill, 2010.

Reference Books

1. Claus Borgnakke Richard E. Sonntag, G J Van Wylen Fundamentals of Thermodynamics, 7/e, Wiley, 2009

2. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021

3. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e, Prentice Hall, New edition

4. P.Chattopadhyay, Engineering Thermodynamics, 1/e, Oxford University Press, 2011.

Online Learning Resources:

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

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – III Semester

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

Course Objectives

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

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

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

Unit- II	**SHEAR FORCE AND BENDING MOMENT**	**8**

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

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

Theory of simple bending, Derivation of bending equation, Determination of bending stresses – section modulus of rectangular, circular, I and T sections– Design of simple beam sections.
SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I and T sections.

Unit- IV	**DEFLECTION OF BEAMS**	**10**

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

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

Unit- V	THIN AND THICK CYLINDERS	**10**

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

COLUMNS:

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

Course Outcomes(CO):

CO1. Learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components

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

CO3. Apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, and moments.

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

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

Text Books:

1. GH Ryder, Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.

2. B.C. Punmia, Strength of materials, 10/e, Lakshmi publications Pvt.Ltd, New Delhi, 2018

Reference Books:

1. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.

2. U.C. Jindal, Strength of Materials, 2/e, Pearson Education, 2017.

3. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.

4. Andrew Pytel and Ferdinand L. Singer, Strength of Materials, 4/e, Longman Pulications, 1990.

5. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ce18/preview.

2. https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6.

3. https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s

4. https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204

5. https://www.coursera.org/learn/mechanics-1

6. https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior

7. https://archive.nptel.ac.in/courses/112/107/112107146/

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DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. ME – III Semester

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

Course Objectives:

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

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

Crystallization of metals, Packing Factor - SC, BCC, FCC & HCP- line density, plane density. Grain and grain boundaries, effect of grain boundaries – determination of grain size.

Imperfections, Slip and Twinning.

Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe_3C.

Unit- II	**Ferrous metals and alloys**	**8**

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

Non-ferrous Metals and Alloys: Structure and properties of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

Unit- III	**Heat treatment of Steels**	**10**

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

Unit- IV	Powder Metallurgy	10

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

Unit- V	Ceramic and Advanced materials	

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

Course Outcomes:

CO1. Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.

CO2. Study the behavior of ferrous and non-ferrous metals and alloys and their application in different domains.

CO3. Understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.

CO4. Grasp the methods of making of metal powders and applications of powder metallurgy.

CO5. Comprehend the properties and applications of ceramic, composites and other advanced methods.

Text Books:

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

Reference Books:

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

Online Learning Resources:

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

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – III Semester

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

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

Syllabus	**Total Hours:48**

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

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

B) MATERIAL SCIENCE LAB:
1. Preparation and study of the Microstructure of pure metals.
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels.
3. Study of the Microstructures of Cast Irons.
4. Study of the Microstructures of Non-Ferrous alloys.

5. Study of the Microstructures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.

<u>Virtual lab:</u>

1. To investigate the principal stresses σa and σb at any given point of a structural element or machine component when it is in a state of plane stress. (https://virtual-labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html)

2. To find the impact resistance of mild steel and cast iron.(https://sm-nitk.vlabs.ac.in/exp/izod-impact-test).

3. To find the impact resistance of mild steel.(https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/index.html)

4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test)

5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test).

Course Outcomes:

CO1: Understand the stress strain behavior of different materials.

CO2: Evaluate the hardness of different materials.

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

CO4: Identify various microstructures of steels and cast irons.

CO5: Evaluate hardness of treated and untreated steels.

DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – III Semester

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

Course Objectives:

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

Syllabus	**Total Hours:48**

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

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

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

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

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

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

Course Outcomes:

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

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

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

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

CO5. Translate 3D assemblies into 2D drawings.

Text Books:

1. Machine Drawing by K.L.Narayana,P.Kannaiah and K.Venkat Reddy, New Age International Publishers,3/e,2014

2. Machine Drawing by N.Sideshwar,P.Kannaiah V.V.S.Sastry, TMH Publishers,2014

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

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.

2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.

3. N.D.Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.

Online Learning Resources:

1. https://eeedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf

2. https://archive.nptel.ac.in/courses/112/105/112105294/

3. https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete

4. https://www.youtube.com/watch?v=0bQkS3_3Fq4

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – III Semester

Python Programming					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0510P	**0: 0: 2: 0**	**1**	**CIE:30 SEE:70**	**3 Hours**	**ES**

Course Objectives:

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

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

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.

i) Arithmetic Operators ii) Relational Operators iii) Assignment Operatorsiv) Logical

Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators

viii) Identity Operators

5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

Unit- II	**Functions and Strings**	**7**

Functions: Built-In Functions, Commonly Used Units, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.

8. Write a program to define a function using default arguments.

9. Write a program to find the length of the string without using any library functions.

10. Write a program to check if the substring is present in a given string or not.

11. Write a program to perform the given operations on a list:

i. Addition ii. Insertion iii. slicing

12. Write a program to perform any 5 built-in functions by taking any list.

Unit- III	Dictionaries, Tuples and Sets	6

Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozen set.

Sample Experiments:

13. Write a program to create tuples (name, age, address, college) for at least two members

and concatenate the tuples and print the concatenated tuples.

14. Write a program to count the number of vowels in a string (No control flow allowed).

15. Write a program to check if a given key exists in a dictionary or not.

16. Write a program to add a new key-value pair to an existing dictionary.

17. Write a program to sum all the items in a given dictionary.

Unit- IV	Files, Object-Oriented Programming	6

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

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file

should have only lower-case words, so any upper-case words from source must be

lowered.

19. Python program to print each line of a file in reverse order.

20. Python program to compute the number of characters, words and lines in a file.

21. Write a program to create, display, append, insert and reverse the order of the items

in the array.

22. Write a program to add, transpose and multiply two matrices.

23. Write a Python program to create a class that represents a shape. Include methods to

calculate its area and perimeter. Implement subclasses for different shapes like circle,

triangle, and square.

Unit- V	Data Science	6

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

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
a) Apply head () function to the pandas data frame
b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Course Outcomes:

CO1. Classify data structures of Python (L4)

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

CO3. Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3)

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

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

CO6. Propose new solutions to computational problems (L6)

Text Books:

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

Reference Books:

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

Online Learning Resources:

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

Online Learning Sources:

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview.
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview.
3. https://archive.nptel.ac.in/courses/108/105/108105057/
4. https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austinembedded-systems-shape-the-world-microcontroller-inputoutput? index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+ World%3A+ Microcontroller+Input%2FOutput&source=edX&productcategory= course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems.

5. https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valenciaintroduction-
6. to-the-internet-ofthings?
   index=product&queryID=e1322674dcb3d246be981d0669265399&position=4
7. &linked_from=autocomplete&c=autocomplete.
8. https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-anddevices?
9. index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results_level=first
   -level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257-a1b38ec07e85&
   campaign =IoT+ Sensors+and+Devices&source=edX&product_category=course&placement_
   url=https%3A%2F%2Fwww.edx.org%2Fsearch.
10. Virtual Labs - http://vlabs.iitkgp.ac.in/rtes/
11. Virtual Labs -https://cse02-iiith.vlabs.ac.in/
12. Virtual Labs - https://iotvirtuallab.github.io/vlab/Experiments/index.html

DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – III Semester

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

Course Objectives:

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

Syllabus	**Total Hours:48**

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

1. Measure Analog signal from Temperature Sensor.

2. Generate PWM output.

3. Drive single character generation on Hyper Terminal.

4. Drive a given string on Hyper Terminal.

5. Full duplex Link establishment using Hyper terminal.

6. Drive a given value on a 8 bit DAC consisting of SPI.

7. Drive Stepper motor using Analog GPIOs.

8. Drive Accelerometer and Display the readings on Hyper Terminal.

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

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

1. Getting started with Raspberry Pi, Install Raspian on your SD card.

2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace

3. and debug Python code on the device.

4. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.

5. Raspberry Pi interact with online services through the use of public APIs and SDKs.

6. Study and Install IDE of Arduino and different types of Arduino.

7. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.

8. Calculate the distance using distance sensor Using Arduino.

9. Basic LED functionality Using Arduino and Node MCU.

10. Calculate the moisture content in the soil using Arduino and Node MCU.

11. Calculate the distance using distance sensor Using Node MCU.

12. Basic LED functionality Using Node MCU.

Course Outcomes:

CO1. Comprehend Microcontroller-Transducers Interface techniques.

CO2. Establish Serial Communication link with Arduino

CO3. Analyse basics of SPI interface.

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

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

Text Books:

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

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – III Semester

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

Course Objectives:

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

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

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

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

Unit- II		**7**

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

a. Forest ecosystem.

b. Grassland ecosystem

c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

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

Unit- III		6

Environmental Pollution: Definition, Cause, effects and control measures of :
a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

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

Unit- IV		6

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

Unit- V		6

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

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

Course Outcomes:
CO1.   Classify data structures of Python (L4)
CO2.   Apply Python programming concepts to solve a variety of computational problems (L3)
CO3.   Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3)
CO4.   Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
CO5.   Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)
CO6.   Propose new solutions to computational problems (L6)

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

Reference Books:

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

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DEPARTMENT OF MECHANICAL ENGINEERING

No.	Course Code	Category	Course Name	L	T	P	Credits
			Semester–IV				
1.	23A0022T	Management Elective- I	Managerial Economics and Financial Analysis	2	0	0	2
	23A0023T		Business Environment				
	23A0024T		Organizational Behavior				
2.	23A0016T	Engineering Science	Complex Variables, Probability and Statistics	3	0	0	3
3.	23A0310T	Professional Core	Manufacturing processes	3	0	0	3
4.	23A0311T	Professional Core	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5.	23A0312T	Professional Core	Design of Machine Members	3	0	0	3
6.	23A0313P	Professional Core	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7.	23A0314P	Professional Core	Manufacturing processes Lab	0	0	3	1.5
8.	23A0026P	Skill Enhancement course	Soft Skills	0	1	2	2
9.	23A0413T	BS&H	Design Thinking & Innovation	1	0	2	2
Total				**15**	**1**	**10**	**21**

Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation

Category	Credits
Management Elective	2
Engineering Science Course (ESC)	3
Professional Core Course (PCC)	12
Skill Enhancement Course (SEC)	2
Basic Science & Humanities Course (BS&H)	2
Total	21

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – IV Semester

Managerial Economics and Financial Analysis (Common to CIV, EEE, ECE, CSE, CSE(DS))					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0022T	**2:0:0:0**	**2**	**CIE:30 SEE:70**	**3 Hours**	**ME**

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To Know the Various types of market structure and pricing methods and strategy.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Syllabus		**Total Hours:32**
Unit-I	**MANAGERIAL ECONOMICS**	**7 Hrs**
Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.		
Unit-II	**PRODUCTION AND COST ANALYSIS**	**7 Hrs**
Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).		
Unit-III	**BUSINESS ORGANIZATIONS AND MARKETS**	**6 Hrs**
Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies		
Unit-IV	**CAPITAL BUDGETING**	**6 Hrs**
Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)		
Unit-V	**FINANCIAL ACCOUNTING AND ANALYSIS**	**6 Hrs**
Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.		

Course Outcomes(CO):

On completion of this course, student will be able to
CO1. Define the concepts related to Managerial Economics, financial accounting and management(L2).
CO2. Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets. (L2)
CO3. Apply the Concept of Production cost and revenues for effective Business decision. (L3)
CO4. Analyze how to invest their capital and maximize returns. (L4)
CO5. Evaluate the capital budgeting techniques. (L5)
CO6. Develop the accounting statements and evaluate the financial performance of business entity (L5)

Textbooks:
1. Varshney & Maheswari: Managerial Economics, Sultan Chand
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH

Reference Books:
1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning resources:
1. https://www.slideshare.net/123ps/managerial-economics-ppt
2. https://www.slideshare.net/rossanz/production-and-cost-45827016
3. https://www.slideshare.net/darkyla/business-organizations-19917607
4. https://www.slideshare.net/balarajbl/market-and-classification-of-market
5. https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
6. https://www.slideshare.net/ashu1983/financial-accounting

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – IV Semester

Business Environment					
(Common to CIV, EEE, ECE, CSE, CSE(DS))					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0023T	2:0:0:0	2	CIE:30 SEE:70	3 Hours	ME

Course Objectives:
- To make the student to understand about the business environment
- To enable them in knowing the importance of fiscal and monitory policy
- To facilitate them in understanding the export policy of the country
- To Impart knowledge about the functioning and role of WTO
- To Encourage the student in knowing the structure of stock markets

Syllabus		Total Hours:32
Unit-I	**OVERVIEW OF BUSINESS ENVIRONMENT**	**7Hrs**

Introduction – Meaning, Nature, Scope, Significance, Functions and Advantages. Types-Internal &External, Micro and Macro. Competitive structure of industries -Environmental analysis-advantages & limitations of environmental analysis.

Unit-II	**FISCALPOLICY & MONETARY POLICY**	**7 Hrs**

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GoI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.

Unit-III	**INDIA'S TRADE POLICY**	**6Hrs**

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Unit-IV	**WORLD TRADE ORGANIZATION**	**6Hrs**

Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

Unit-V	**MONEY MARKETS AND CAPITAL MARKETS**	**6Hrs**

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.

Course Outcomes(CO):

On completion of this course, student will be able to
- CO1. Define Business Environment and its Importance. (L2)
- CO2. Understand various types of business environment. (L2)
- CO3. Apply the knowledge of Money markets in future investment (L3)
- CO4. Analyse India's Trade Policy (L4)

CO5. Evaluate fiscal and monitory policy (L5)

CO6. Develop a personal synthesis and approach for identifying business opportunities (L5)

Textbooks:

1. Francis Cherunilam, International Business: Text and Cases, Prentice Hall of India.

2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH.

Reference Books:

1. K. V. Sivayya, V. B. M Das, Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black, International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N, International Business, Wiley India.

4. E. Bhattacharya, International Business, Excel Publications, New Delhi.

Online Learning Resources:

1. https://www.slideshare.net/ShompaDhali/business-environment-53111245

2. https://www.slideshare.net/rbalsells/fiscal-policy-ppt

3. https://www.slideshare.net/aguness/monetary-policy-presentationppt

4. https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982

5. https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt

6. https://www.slideshare.net/viking2690/wto-ppt-60260883

7. https://www.slideshare.net/prateeknepal3/ppt-mo

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – IV Semester

Organizational Behaviour					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
23A0024T	**2:0:0:0**	**2**	**CIE:30 SEE:70**	**3 Hours**	**ME**

Course Objectives:

- To enable student's comprehension of organizational behavior
- To offer knowledge to students on self-motivation, leadership and management
- To facilitate them to become powerful leaders
- To Impart knowledge about group dynamics
- To make them understand the importance of change and development

Syllabus		**Total Hours:32**
Unit-I	**INTRODUCTION TO ORGANIZATIONAL BEHAVIOR**	**7Hrs**

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective - Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.

Unit-II	**MOTIVATION AND LEADING**	**7Hrs**

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory.

Unit-III	**ORGANIZATIONAL CULTURE**	**6Hrs**

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership -
Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of
good Leader - Conflict Management -Evaluating Leader.

Unit-IV	**GROUP DYNAMICS**	**6Hrs**

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behaviour - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution.

Unit-V	**ORGANIZATIONAL CHANGE AND DEVELOPMENT**	**6Hrs**

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

Course Outcomes(CO):

On completion of this course, student will be able to
 CO1. Define the Organizational Behaviour, its nature and scope. (L2)
 CO2. Understand the nature and concept of Organizational behaviour (L2)
 CO3. Apply theories of motivation to analyse the performance problems (L3)
 CO4. Analyse the different theories of leadership (L4)
 CO5. Evaluate group dynamics (L5)
 CO6. Develop as powerful leader (L5)

Textbooks:

1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition.
2. P Subba Ran, Organisational Behaviour, Himalya Publishing House.

Reference Books:

1. McShane, Organizational Behaviour, TMH.
2. Nelson, Organisational Behaviour, Thomson.
3. Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson.
4. Aswathappa, Organisational Behaviour, Himalaya.

Online Learning Resources:

1. https://www.slideshare.net/Knight1040/organizational-culture.
2. 9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714 .
3. https://www.slideshare.net/harshrastogi1/group-dynamics-159412405.
4. https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951.

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – IV Semester

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

Syllabus	**Total Hours:48**

Unit-I	**Complex Variable – Differentiation**	**10Hrs**
Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.		
Unit-II	**Complex Variable – Integration**	**10Hrs**
Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof).		
Unit-III	**Probability theory**	**10Hrs**
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem Random variables (discrete and continuous), probability density functions, properties, mathematical expectation.		
Unit-IV	**Probability Distributions**	**9Hrs**
Probability distribution - Binomial, Poisson approximation to the binomial distribution, Normal distribution and their properties.		
Unit-V	**Estimation and Testing of hypothesis, large sample tests**	**9Hrs**
Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems.		
Course Outcomes: After successful completion of this course, the students should be able to: CO1: Understand Cauchy Riemann equations, analytic functions and various properties of analytic functions. CO2: Understand Cauchy's theorem, Cauchy integral formulas, Classify singularities and poles. Evaluate complex integrals using the residue theorem. CO3: Apply Probability theory to find the chances of happening of events. CO4: Understand various probability distributions and calculate their statistical constants. CO5: Analyze to test various hypotheses included in theory and types of errors for large samples.		

Text books:

1. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.
2. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.India
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition

Reference Books:

1. ErwinKreyszig, Advanced Engineering Mathematics, JohnWiley&Sons, 2018, 10th Edition.
2. R.K.JainandS.R.K.Iyengar,AdvancedEngineeringMathematics,AlphaScienceInternationalLtd.,2021 5th Edition(9th reprint).
3. Ronald E. Walpole, Probability and Statistics for Engineers and Scientists, PNIE
4. H. K Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publications,2014, Third Edition (Reprint 2021)

Online Learning Resources:

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

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DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. ME – IV Semester

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

Course Objectives:

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

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

Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores , Principles of Gating, Risers, casting design considerations. Methods of melting and types of furnaces, Solidification of castings and casting defects- causes and remedies. Basic principles and applications of special casting processes - Centrifugal casting, Die casting, Investment casting and shell molding.

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

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

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

Heat affected zones in welding; pre & post heating, welding defects –causes and remedies.

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

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

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

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

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

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

Unit- V	Additive manufacturing	10

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

Course Outcomes(CO):

CO1: Design the patterns and core boxes for metal casting processes

CO2: Understand the different welding processes

CO3: Demonstrate the different types of bulk forming processes

CO4: Understand sheet metal forming processes

CO5: Learn about the different types of additive manufacturing processes

Textbooks:

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

Reference Books

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

Online Learning Resources:

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

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DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. ME – IV Semester

Fluid Mechanics & Hydraulic Machines					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
23A0311T	**3: 0: 0: 0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**PC**
Course Objectives:					

- Understand the properties of fluids, manometry, hydrostatic forces acting on different surfaces

- Understand the kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations.

- Understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.

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

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

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of meta center height. Stability analysis and applications.

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

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

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

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

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

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

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

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

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

Unit- V	Performance of hydraulic turbines	10

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

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

Course Outcomes(CO):

CO1. Understand the basic concepts of fluid properties.

CO2. Estimate the mechanics of fluids in static and dynamic conditions.

CO3. Apply the Boundary layer theory, flow separation and dimensional analysis.

CO4. Estimate the hydrodynamic forces of jet on vanes in different positions.

CO5. Understand the working Principles and performance evaluation of hydraulic pump and turbines.

Text Books:

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

Reference Books

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

Online Learning Resources:

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

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – IV Semester

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

Course Objectives:

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

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

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials.

Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and combinations ,impact loads . Theories of failure for static loads.

Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses

Unit- II	**Design of Bolted and Welded Joints**	**8**

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints.

Welded Joints: Strength of lap and butt welds, Joints subjected to bending and torsion. Eccentrically loaded welded joints

Unit- III	**Power transmission Shafts and Couplings**	**10**

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

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

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

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

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

Unit- V	Design of Bearings and Gears	10

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

Course Outcomes(CO):

CO1. Estimate safety factors of machine members subjected to static and dynamic loads.

CO2. Design the fasteners subjected to variety of loads.

CO3. Select of standard machine elements such as keys, shafts, couplings, springs and bearings.

CO4. Design of clutches, brakes and springs.

CO5. Design of bearing and gears.

Text Books:

1. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004.
2. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
3. Dr. N. C. Pandya &Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.
4. Fundamentals of Design and Manufacturing , G. K. Lal, Vijay Gupta, N. Venkata Reddy, Narosa Publishing house.

Reference Books

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.
4. K. Mahadevan & K. Balaveera Reddy, Design data handbook, CBS Publications, 4/e, 2018. Machine design sham series

Online Learning Resources:

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

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DEPARTMENT OF MECHANICAL ENGINEERING

II Year B.Tech. ME – IV Semester

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

Course Objectives:

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

Syllabus	Total Hours:48

List of Experiments

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

Virtual Lab:

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

Course Outcomes:

CO1. Demonstrate the devices used for measuring flow.

CO2. Compute major losses in pipes.

CO3. Illustrate the operating parameters of turbines.

CO4. Explain the working of different types of pumps.

CO5. Explain the devices used for measuring flow.

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – IV Semester

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

List of Experiments

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

Virtual Lab:

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

Course Outcomes:

CO1. Make moulds for sand casting.
CO2. Fabricate different types of components using various manufacturing techniques.
CO3. Adapt unconventional manufacturing methods.
CO4. Develop Different Weld joints.
CO5. Explain different types of 3d Printing techniques.

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DEPARTMENT OF MECHANICAL ENGINEERING
II Year B.Tech. ME – IV Semester

<table>
<tr><td colspan="6" align="center">Soft Skills
(ECE CIVIL MECH)</td></tr>
<tr><td>Course Code</td><td>L:T: P: S</td><td>Credits</td><td>Exam marks</td><td>Exam Duration</td><td>Course Type</td></tr>
<tr><td>23A0026P</td><td>0: 1: 2: 0</td><td>2</td><td>CIE:30 SEE:70</td><td>3 Hours</td><td>SEC</td></tr>
</table>

Course Objectives:

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

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

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

Activities:

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

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

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

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

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

Unit - II	**Problem Solving & Decision Making**	**8Hrs**

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

Activities:

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

Unit - III	**Critical Thinking**	**10 Hrs**

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

Activities:

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

Unit - IV	**Emotional Intelligence & Stress Management**	**10 Hrs**

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:

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

Unit - V	**Corporate Etiquette**	**10 Hrs**

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

Course Outcomes (CO):

On completion of this course, student will be able to

CO1. List out various elements of soft skills

CO2. Describe methods for building professional image

CO3. Apply critical thinking skills in problem solving

CO4. Analyze the needs of an individual and team for well-being

CO5. Assess the situation and take necessary decisions

CO6. Create a productive workplace atmosphere using social and work-life skills ensuring personal and emotional well-being

Textbooks:

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

Reference Books:

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
5. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
6. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
7. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher :Vayu Education of India, 2014

Web links:

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

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

Course Objectives:

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

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

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

Unit- II	**Design Thinking Process**	**10**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development
Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Unit- III	**Innovation**	**10**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.
Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Unit- IV	**Product Design**	**10**

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

Unit- V	**Design Thinking in Business Processes**	**10**

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

Course Outcomes(CO):

CO1. Define the concepts related to design thinking. (L1, L2)
CO2. Explain the fundamentals of Design Thinking and innovation (L1, L2)
CO3. Apply the design thinking techniques for solving problems in various sectors. (L3)
CO4. Analyse to work in a multidisciplinary environment (L4)
CO5. Evaluate the value of creativity (L5)
CO6. Formulate specific problem statements of real time issues (L3, L6)

Text Books:

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

Reference Books

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

Online Learning Resources:

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