JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (AUTONOMOUS): KALIKIRI
KALIKIRI-517234, ANNAMAYYA (Dt.)., A.P., INDIA.

B. TECH-MECHANICAL ENGINEERING

II Year
Course Structure

Under R23 Regulations
Effective from AY: 2024-25
(For admitted in Regular 2023-24 and Lateral Entry 2024-25 Students)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS)
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B. TECH-MECHANICAL ENGINEERING

II YEAR COURSE STRUCTURE & SYLLABI

B. Tech II Year-I Semester						
S. No.	**Category**	**Title**	**L/D**	**T**	**P**	**Credits**
1	23ABS11	Numerical Methods &Transform Techniques	**3**	**0**	**0**	**3**
2	23AHS04	Universal Human Values– Understanding Harmony& Ethical human conduct	**2**	**1**	**0**	**3**
3	23AME04T	Thermodynamics	**2**	**0**	**0**	**2**
4	23AME05Ta	Mechanics of Solids	**3**	**0**	**0**	**3**
5	23AME05Tb	Material Science and Metallurgy	**3**	**0**	**0**	**3**
6	23AME05P	Mechanics of Solids and Materials Science Lab	**0**	**0**	**3**	**1.5**
7	23AME06	Computer-Aided Machine Drawing	**0**	**0**	**3**	**1.5**
8	23AME07	Embedded Systems and IoT	**0**	**0**	**2**	**1.0**
9	23ACS07	Python programming	**0**	**1**	**2**	**2**
10	23AHS03	Environmental Science	**2**	**0**	**0**	**-**
Total			**15**	**2**	**10**	**20**

B. Tech II Year-II Semester						
1	23AHS05d	Industrial Management	**2**	**0**	**0**	**2**
2	23ABS16	Complex Variables, Probability and Statistics	**3**	**0**	**0**	**3**
3	23AME08T	Manufacturing Processes	**3**	**0**	**0**	**3**
4	23AME09T	Fluid Mechanics & Hydraulic Machines	**3**	**0**	**0**	**3**
5	23AME10	Theory of Machines	**3**	**0**	**0**	**3**
6	23AME08P	Manufacturing Processes Lab	**0**	**0**	**3**	**1.5**
7	23AME09P	Fluid Mechanics & Hydraulic Machines Lab	**0**	**0**	**3**	**1.5**
8	23AHS06	Soft Skills	**0**	**1**	**2**	**2**
9	23AHSS3	Design Thinking & Innovation	**1**	**0**	**2**	**2**
Total			**15**	**1**	**10**	**21**
Mandatory **Community Service Project of 08 weeks'** duration during Summer Vacation						

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B. TECH-MECHANICAL ENGINEERING

B. Tech II Year-I Semester						
S. No.	**Category**	**Title**	**L/D**	**T**	**P**	**Credits**
1	23ABS11	Numerical Methods &Transform Techniques	**3**	**0**	**0**	**3**
2	23AHS04	Universal Human Values– Understanding Harmony& Ethical human conduct	**2**	**1**	**0**	**3**
3	23AME04T	Thermodynamics	**2**	**0**	**0**	**2**
4	23AME05Ta	Mechanics of Solids	**3**	**0**	**0**	**3**
5	23AME05Tb	Material Science and Metallurgy	**3**	**0**	**0**	**3**
6	23AME05P	Mechanics of Solids and Materials Science Lab	**0**	**0**	**3**	**1.5**
7	23AME06	Computer-Aided Machine Drawing	**0**	**0**	**3**	**1.5**
8	23AME07	Embedded Systems and IoT	**0**	**0**	**2**	**1.0**
9	23ACS07	Python programming	**0**	**1**	**2**	**2**
10	23AHS03	Environmental Science	**2**	**0**	**0**	**-**
Total			**15**	**2**	**10**	**20**

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B. TECH-MECHANICAL ENGINEERING

Course Code	NUMERICAL METHODS & TRANSFORMATION TECHNIQUES	L	T	P	C
23ABS11		3	0	0	3
Semester	**II B. Tech I Semester, ME**				

Course Outcomes (CO): After the Completion of this course, the student should be able to

CO1: Apply numerical methods to solve algebraic and transcendental equations and estimate the predictions through interpolation. (L2,L3)
CO2: Apply the concept of numerical differentiation and integration in solving the related problems. (L3,L5)
CO3: Solve the initial value problems of single variable. (L3)
CO4: Understand the use of Laplace transform in initial Value Problems. (L2, L3)
CO5: Apply Fourier series and Fourier transform in various fields of Mechanical Engineering.(L3,L5)

Unit - I **Solution of Algebraic & Transcendental Equations & Interpolation.**

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method
Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae

Unit - II **Numerical Differentiation., Integration and Curve Fitting**

Numerical differentiation and integration: Numerical differentiation based on Newton's interpolation, Trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule.
Curve fitting: Fitting of a straight line, second-degree and exponential curves by method of least squares.

Unit - III **Solution Of Initial Value Problems to Ordinary Differential Equations**

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

Unit - IV **Laplace Transforms**

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, transforms of derivatives and integrals –Convolution theorem – Laplace transform of Periodic function, Applications tom initial value problems of ordinary differential equations.

Unit - V **Fourier series and Fourier transforms**

Fourier series: Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series -Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions
Fourier transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – Finite Fourier transform.

Learning Resources:

Textbooks:

1. S. S. Sastry, Introductory Methods of Numerical Analysis, 4/e, PHI, 2006, New Delhi.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd.,2021
3. H. K. Das, Er.Rajnish Verma, Higher Engineering Mathematics, 3/e, S. Chand Publications, 2014.
4. Alan Jeffrey, Advanced Engineering Mathematics, Elsevier

Web Resources:

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

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B. TECH-MECHANICAL ENGINEERING

Course Code		L	T	P	C
23AHS04	UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT (Common to all Branches)	2	1	0	3
Semester	**II B. Tech I Sem**				

Course Objectives:

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

Course Outcomes (CO): 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

Course Topics

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

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

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

UNIT II **Harmony in the Human Being** (6 lectures and 3 tutorials for practice session)

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

UNIT III **Harmony in the Family and Society** (6 lectures and 3 tutorials for practice session)

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

UNIT IV	**Harmony in the Nature/Existence** (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

UNIT V	**Implications of the Holistic Understanding – a Look at Professional Ethics** (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies
Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

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

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

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

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

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

Learning Resources:

Textbooks and Teachers Manual

a. The Textbook

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

b. The Teacher's Manual

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

1.

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 Beautifu*l - 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)

Web Resources:

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

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions. While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

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

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential

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B. TECH-MECHANICAL ENGINEERING

Course Code	THERMODYNAMICS	L	T	P	C
23AME04T		2	0	0	2
Semester	**II B. Tech I Semester (ME)**				

Course Objectives:

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

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

CO1: Explain the importance of thermodynamic properties related to conversion of heat energy into work. (L3)
CO2: Apply the Zeroth and First Law of Thermodynamics. (L3)
CO3: Understand Second Law of Thermodynamics. (L2)
CO4: Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, PhaseTransformations (L4)
CO5: Evaluate the COP of refrigerating systems and properties, processes of Psychrometry and sensible and latent heat loads.(L5)

Unit - I	**Introduction**

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

Unit - II	**Energy in State and in Transition**

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

Unit - III	**Second Law of Thermodynamics**

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

Unit - IV	**Pure Substances**

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

Unit - V	**Refrigeration & Air Conditioning**

Introduction to Refrigeration: Working of Air, Vapour compression, VCR system Components,COP Refrigerants.
Introduction to Air Conditioning: Psychrometric properties & processes – characterization ofsensible and latent heat loads – load concepts of SHF.
Requirements of human comfort and concept of effective temperature- comfort chart –comfort air conditioning, and load calculations.

Learning Resources:

Textbooks:

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

Reference Books:

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

Web Resources:

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

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B. TECH-MECHANICAL ENGINEERING

Course Code		L	T	P	C
23AME05Ta	MECHANICS OF SOLIDS	3	0	0	3
Semester	**II B. Tech I Semester (ME)**				

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 behaviour
- Design and analysis of Industrial components like pressure vessels.

Course Outcomes (CO): Student will be able to

Course Outcomes:
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 ofsuch structural components (L1)
CO2: Analyse beams and draw correct and complete shear and bending moment diagrams for beams. (L4)
CO3: Apply the concept of stress and strain to analyze and design structural membersand machine parts under axial, shear and bending loads, and moments.(L3)
CO4: Model &Analyze the behaviour of basic structural members subjected to variousloads **(L4)**
CO5: Design and analysis of Industrial components like pressure vessels.(L6)

Unit - I	**SIMPLE STRESSES & STRAINS**

SIMPLE STRESSES & STRAINS : Elasticity and plasticity – Types of stresses &strains–Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses- Complex Stresses - Stresses on an inclined plane under different uni-axial 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**

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, 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.Mand rate of loading at a section of a beam.

Unit - III	**FLEXURAL STRESSES AND SHEAR STRESSES**

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

Unit - IV	**DEFLECTION OF BEAMS & TORSION**

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

Mohr's theorem and Moment area method – application to simple cases.
TORSION: Introduction-Derivation- Torsion of Circular shafts- Pure Shear-Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

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

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

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

Learning Resources:

Textbooks:

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, LongmanPulications, 1990.
5.Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

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

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B. TECH-MECHANICAL ENGINEERING

Course Code		**L**	**T**	**P**	**C**
23AME05Ta	**MATERIAL SCIENCE & METALLURGY**	**3**	**0**	**0**	**3**
Semester	**II Year B.Tech. – I Semester (ME)**				

Course Objectives: The main objective of the course is to

- Understand the crystalline structure of different metals and study the stability of phases in different alloy systems. (L2)
- Study the behaviour of ferrous and non ferrous metals and alloys and their application in different domains. (L1)
- Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals. (L2)
- Grasp the methods of making of metal powders and applications of powder metallurgy. (L3)
- Comprehend the properties and applications of ceramic, composites and other advanced methods.(L4)

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

CO1: Understand the crystalline structure of different metals and study the stability ofphases in different alloy systems.
CO2: Study the behaviour of ferrous and non-ferrous metals and alloys and their applicationin different domains.
CO3: Understand the effect of heat treatment, addition of alloying elements on propertiesof ferrous metals.
CO4: Grasp the methods of making of metal powders and applications of powdermetallurgy.
CO5: Comprehend the properties and applications of ceramic, composites and otheradvanced methods.

Unit - I : Structure of Metals and Constitution of alloys and Equilibrium Diagrams:

Structure of Metals and Constitution of alloys: 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, Iso-morphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritecticreaction. Transformations in the solid state – allotropy, eutectoid, peri-tectoid 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 and Non-ferrous Metals and their Alloys

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroidal 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

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

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.

Learning Resources:

Textbooks:

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, CLEngineering publications, 2018.

Reference Books:

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

Online Learning Resources:

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

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B. TECH-MECHANICAL ENGINEERING

Course Code	MECHANICS OF SOLIDS AND MATERIALS SCIENCE LAB	L	T	P	C
23AME05P		0	0	3	1.5
Semester	**II Year B.Tech. – I Semester (ME)**				

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.

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

CO1 Understand the stress strain behaviour of different materials.(L2)
CO2: Evaluate the hardness of different materials.(L4)
CO3: Explain the relation between elastic constants and hardness of materials.(L1)
CO4: Identify various microstructures of steels and cast irons.(L3)
CO5: Evaluate hardness of treated and untreated steels.(L4)

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

SECTION-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

SECTION-B
MATERIAL SCIENCELAB

1. Preparation and study of the Microstructure of pure metals
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, andHigh 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.

Learning Resources:

Virtual lab:

1. To investigate the principal stresses σa and σb at any given point of a structural element or machine component when it is in a state of plane stress. (https://virtual- labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html)
2. To find the impact resistance of mild steel and cast iron.(https://sm- nitk.vlabs.ac.in/exp/izod-

impact-test).

3. To find the impact resistance of mild steel.(https://sm-nitk.vlabs.ac.in/exp/charpy- impact-test/index.html)
4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test)
5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (https://sm-nitk.vlabs.ac.in/exp/vickers-hardness- test).

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B. TECH-MECHANICAL ENGINEERING

Course Code	COMPUTER-AIDED MACHINE DRAWING	L	T	P	C
23AME06		0	0	3	1.5
Semester	**II B. Tech I Sem (ME)**				

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

Course Outcomes (CO): Student will be able to

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

List of Experiments:

I. The following are to be done by any 2D software package Conventional representation of materials and components:

1. 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.
2. Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, doubleriveted double strap joints.
3. Welded joints: Lap joint and T joint with fillet, butt joint with conventions.
4. Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.
5. Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universalcoupling, Oldham's' coupling.

II. 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, and 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.

Learning Resources:

Text Books:
1 Machine Drawing byK.L.Narayana, P.Kannaiah and K.Venkat Reddy, New Age International

Publishers, 3/e, 2014 2 Machine drawing by N.Sideshwar, P. Kannaiah, V.V.S.Sastry, TMH Publishers.2014.
Reference Books: 1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided EngineeringDrawing, Tata McGraw-Hill, NY, 2000. 2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, KoganPage Science, 2003. 3. N. D. Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.
Online Learning Resources: • https://eeedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf • https://archive.nptel.ac.in/courses/112/105/112105294/ • https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete • https://www.youtube.com/watch?v=0bQkS3_3Fq4

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B. TECH-MECHANICAL ENGINEERING

Course Code	EMBEDDED SYSTEMS & IoT	L	T	P	C
23AME07		0	0	2	1
Semester	II B. Tech I Semester (ME)				

Course Objectives:

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

Course Outcomes (CO): By the end of the course, the student will be able to:

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

Embedded Systems Experiments

Any 5 experiments from the following

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

COMPONENTS/ BOARDS: 1. Arduino Due milanove Board 2. Arduino Software IDE.

Learning Resources:

Text Books:

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

Internet of Things Experiments

Any 5 experiments from the following

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
3. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
4. Raspberry Pi interacts with online services through the use of public APIs and SDKs.
5. Study and Install IDE of Arduino and different types of Arduino.
6. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
7. Calculate the distance using distance sensor Using Arduino.

8. Basic LED functionality Using Arduino and Node MCU.
9. Calculate the moisture content in the soil using Arduino and Node MCU.
10. Calculate the distance using distance sensor Using Node MCU.
11. Basic LED functionality Using Node MCU.

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B. TECH-MECHANICAL ENGINEERING

Course Code	PYTHON PROGRAMMING	L	T	P	C
23ACS07		0	1	2	2
Semester	**II Year B.Tech. – I Semester (Common To CSE, ECE, MECH, FDT)**				

Course Objectives: The main objective of the course is to

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

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

CO1: Showcase adept command of Python syntax, deftly utilizing variables, data types, control structures, functions, modules, and exception handling to engineer robust and efficient code solutions. (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: 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)

Unit - I

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

Sample Experiments:

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

Unit - II

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings.
Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

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

Unit - III

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

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

Sample Experiments:

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

Unit - IV

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

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

Sample Experiments:

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

Unit - V

UNIT-V:

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

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:

a) Apply head () function to the pandas data frame
b) Perform various data selection operations on Data Frame

30. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in mat plot lib.

Learning Resources:

Reference Books:

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

Online Learning Resources/Virtual Labs:

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

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B. TECH-MECHANICAL ENGINEERING

Course Code	ENVIRONMENTAL SCIENCE	L	T	P	C
23AHS03	(Common to all Branches)	2	0	0	0
Semester	**II B. Tech I Sem**				

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.
- To understand the problems related to social issues and Wild life protection acts.
- To know the importance of value education and welfare programs.

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

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

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Cause of population explosion, value education and welfare programs.

UNIT I

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

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

Learning outcomes:

At the end of this unit, the students will be able to

- To know the importance of public awareness
- Explain how natural resources should be used.

UNIT II

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

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

Biodiversity and Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity — Bio-geographical classification of India — Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values — Biodiversity at global, National and local levels — India as a mega-diversity nation — Hot-sports of biodiversity — Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife

conflicts — Endangered and endemic species of India — Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

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

a. Air Pollution.
b. Water pollution
c. Soi1 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.

Learning outcomes:

At the end of this unit, the students will be able

- To understand the causes, effects and preventive measures of various pollution.
- To understand the various sources of solid waste and preventive measures.
- To know about the different types of disasters and their managerial measures.

UNIT IV

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

Learning outcomes:

At the end of this unit, the students will be able to

- To know about the social issues related to environment and their protection acts.
- To know about the various sources of conservation of natural resources.

UNIT V

Human Population and The Environment: Population growth, variation among nations. Population explosion — Family Welfare Programs. — 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...

Learning outcomes:

At the end of this unit, the students will be able

- To understand population explosion and family welfare programs.
- To identify the natural assets and related case studies.

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press, 2nd Edition, 2013.
2. Palaniswamy, "Environmental Studies", Pearson education, 2nd Edition. 2014.
3. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd., 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage

Publications, Revised Edition, 2023.
2. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications, 3rd Edition, 2009.
3. J. G. Henry and G. W. Heinke, "Environmental Sciences and Engineering", Prentice hall of India Private limited, 2nd Edition 2007.
4. G.R.Chatwa1, "A Text Book of Environmental Studies" Himalaya Publishing House, 1st edition, 2004.
5. G. M. Masters and W. P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited, 3rd Edition, 2008.

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B. TECH-MECHANICAL ENGINEERING

B. Tech II Year-II Semester						
1	23AHS05d	Industrial Management	2	0	0	2
2	23ABS16	Complex Variables, Probability and Statistics	3	0	0	3
3	23AME08T	Manufacturing Processes	3	0	0	3
4	23AME09T	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	23AME10	Theory of Machines	3	0	0	3
6	23AME08P	Manufacturing Processes Lab	0	0	3	1.5
7	23AME09P	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
8	23AHS06	Soft Skills	0	1	2	2
9	23AHSS3	Design Thinking & Innovation	1	0	2	2
Total			**15**	**1**	**10**	**21**
Mandatory **Community Service Project of 08 weeks'** duration during summer Vacation						

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B. TECH-MECHANICAL ENGINEERING

Course Code	INDUSTRIAL MANAGEMENT	L	T	P	C
23AHS05d		2	0	0	2
Semester	**II B. Tech II Semester (ME)**				

Course Objectives:

- Introduce the scope and role of industrial engineering and the techniques for optimal design of layouts
- Illustrate how work study is used to improve productivity
- Explain TQM and quality control techniques
- Introduce financial management aspects and
- Discuss human resource management and value analysis.

Course Outcomes (CO): Student will be able to

- Define industrial engineering and its Importance. (L2)
- Understand various types of production. (L2)
- Demonstrate work study methods. (L3)
- Discuss the financial management aspects (L4)
- Understand the human resource management methods. (L2)

UNIT - I **INTRODUCTION**

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

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

UNIT - II **WORK STUDY**

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

UNIT - III **STATISTICAL QUALITY CONTROL**

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

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

UNIT - IV **FINANCIAL MANAGEMENT**

Scope and nature of financial management, Sources of finance, Management of working capital, estimation of working capital requirements, budget and budgetary control, Capital budgeting – Nature of Investment Decisions– Investment Evaluation criteria-NPV, IRR, PI, Payback Period, and ARR, numerical problems.

Unit - V	**HUMAN RESOURCE MANAGEMENT**

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

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

Learning Resources:

Textbooks:

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

Reference Books:

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

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B. TECH-MECHANICAL ENGINEERING

Course Code		L	T	P	C
23ABS16	COMPLEX VARIABLES, PROBABILITY AND STATISTICS	3	0	0	3
Semester	**II B. Tech II Semester (ME)**				

Course Objectives:

To expose to the field of complex variables, statistics and testing of hypothesis, and their applications in mechanical engineering.

Course Outcomes (CO): Student will be able to

CO1: Analyse the behaviour of a complex function and understand Cauchy-Riemann equations in testing the analytic functions. (L2, L3).

CO2: Understand Cauchy integral theorem and use the Cauchy integral formula in evaluating the complex integrals. Expand the complex functions in series and able to find residues and evaluate complex integrals using the residue theorem. (L3, L5).

CO3: Apply Probability theory to find the chances of happening of events in day-to-day problems. (L3).

CO4: Understand various probability distributions and calculate their statistical constants. (L2, L3).

CO5: Analyse to test the hypotheses and apply it in decision making for large samples (L3, L5).

Pre-requisite:	Basic knowledge on complex numbers, Probability, random variables (discrete and continuous), and probability distributions.
Unit - I	**COMPLEX VARIABLE – DIFFERENTIATION**

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

Unit - II	**COMPLEX VARIABLE – INTEGRATION**

Line integral- 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 AND RANDOM VARIABLE**

Sample spaces and events, Probability, the axioms of probability, some elementary theorems, conditional probability, Baye's theorem.
Random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

Unit - IV	**PROBABILITY DISTRIBUTIONS**

Probability distribution - Binomial, Poisson approximation to the binomial distribution, Normal distribution and their properties.
Sampling distributions: Population and Sample, the sampling distribution of means (σ known and σ unknown).

Unit - V	**ESTIMATION AND TESTING OF HYPOTHESIS, LARGE SAMPLE TESTS**

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

Learning Resources:

Textbooks:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers,2017, New Delhi.
2. Richard A Johnson, Miller & Freund's Probability and Statistics for Engineers, 7/e, Pearson, 2008, India.

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2002.
2. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2006, New Delhi.
3. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

Web Resources:

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

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B. TECH-MECHANICAL ENGINEERING

Course Code	MANUFACTURING PROCESSES	L	T	P	C
23AME08T		3	0	0	3
Semester	**II B. Tech II Semester (ME)**				

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 arolling mill and types, extrusion processes.
- Understand the principles of forging, tools and dies, working of forging processes.
- Know about the Additive manufacturing.

Course Outcomes (CO): Student will be able to

CO1: Design the patterns and core boxes for metal casting processes (L6)
CO2: Understand the different welding processes.(L2)
CO3: Demonstrate the different types of bulk forming processes (L3)
CO4: Understand sheet metal forming processes (L2)
CO5: Learn about the different types of additive manufacturing processes. (L2)

Unit - I **Casting**

Casting: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern 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**

Welding: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy – Acetylene Gas cutting. Basic 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**

Bulk Forming: 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**

Sheet metal forming-Blanking and piercing, Forces and power requirement in these operations, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Spinning, Coining, 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**

Additive manufacturing - Steps in Additive Manufacturing (AM), Classification of AM processes,

Advantages of AM, and types of materials for AM, VAT photo polymerization AM Processes, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications

Learning Resources:

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.

Web Resources:

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

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B.TECH-MECHANICAL ENGINEERING

Course Code	FLUID MECHANICS & HYDRAULIC MACHINES	L	T	P	C
23AME09T		3	0	0	3
Semester	**II B. Tech II Semester (ME)**				

Course Objectives: The students completing this course are expected

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

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

CO1: Understand the basic concepts of fluid properties (L2)
CO2: Estimate the mechanics of fluids in static and dynamic conditions. (L5)
CO3: Apply the Boundary layer theory, flow separation and dimensional analysis. (L3)
CO4: Estimate the hydrodynamic forces of jet on vanes in different positions (L5)
CO5: Understand the working Principles and performance evaluation of hydraulic pump and turbines (L2)

Unit - I	**Fluid statics and Buoyancy and floatation**

Fluid statics: Dimensions and units: physical properties of fluids - specific gravity, viscosity and its significance, surface tension, capillarity, and 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 and Closed conduit flow**

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circula tion 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 streamline, momentum equation and its applications, force on pipe bend.
Closed conduit flow: Reynold's experiment- Darcy Weisbach equation- Minor losses in pipes-pipesinseriesandpipesinparallel-totalenergyline-hydraulicgradientline.

Unit - III	**Boundary Layer Theory and Dimensional Analysis**:

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.
Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

Unit - IV	**Basics of turbo machinery & Hydraulic Turbines**:

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, hydraulic design – draft tube-theory-functions and efficiency.

Unit - II	**Performance of hydraulic turbines, Centrifugal pumps & Reciprocating pumps**

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

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

Reciprocating pumps: Working, Discharge, slip, indicator diagrams.

Learning Resources:

Textbooks:

1. Y.A.Cengel, J.M. Cimbala, Fluid Mechanics, Fundamentals andApplications, 6/e, McGraw Hill Publications, 2019.
2. Dixon,Fluid Mechanics and Thermodynamics of Turbomachinery,7/e, ElsevierPublishers, 2014.

Reference Books:

1. 1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including HydraulicsMachines, Standard Book House, 2017.
2. R KBansal, Fluid Mechanics and Hydraulic Machines, 10/e, Laxmi Publications(P)Ltd,2019.
3. Rajput, Fluid Mechanics and Hydraulic Machines, S Chand & Company, 2016.
4. D.S.Kumar, Fluid Mechanics and Fluid Power Engineering, S K Kataria &Sons, 2013.
5. D.Rama Durgaiah, Fluid Mechanic sand Machinery,1/e, New Age International, 2002.

Online Learning Resources

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

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B. TECH-MECHANICAL ENGINEERING

Course Code	THEORY OF MACHINES	L	T	P	C
23AME10		3	0	0	3
Semester	**II B. Tech II Semester (ME)**				

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

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

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

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

Unit - I	**Simple Mechanisms**

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

Unit - II	**Plane and motion analysis:**

Plane and motion analysis: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations – kinematic analysis of simple mechanisms – slider crank mechanism dynamics – Coincident points – Coriolis component of acceleration.

Unit - III	**Gyroscope & Gear Profile**

Gyroscope: Principle of gyroscope, gyroscopic effect in an aero plane, ship, car and two wheelers, simple problems
Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics

Unit - IV	**Balancing of Rotating masses & Cams**

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses indifferent planes, using analytical and graphical methods.
Cams: Classification of cams and followers- Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – derivatives of followermotions- specified contour cams- circular and tangent cams –pressure angle and undercutting.

Unit - V	**Vibrations & Turning Moment Diagrams and Flywheel**

Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.
Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.

Learning Resources:

Textbooks:

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

Reference Books:

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

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B. TECH-MECHANICAL ENGINEERING

Course Code	MANUFACTURING PROCESSES LAB	L	T	P	C
23AME08P		0	0	3	1.5
Semester	II B. Tech II Sem (ME)				

Course Objectives:

Acquire practical knowledge on Metal Casting, Welding, Press Workingand Processing of Plastics.

Course Outcomes (CO): Student will be able to

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

List of Experiments

1. 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 weld ments 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

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B. TECH-MECHANICAL ENGINEERING

Course Code	FLUID MECHANICS & HYDRAULIC MACHINERY LAB	L	T	P	C
23AME09P		0	0	3	1.5
Semester	**II B. Tech II Semester (ME)**				

Course Objectives:

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

Course Outcomes (CO): Student will be able to

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

List of Experiments

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

Learning Resources:

Virtual Lab:

1. To study different patterns of a flow through a pipe and correlate them with theReynolds 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 centre of the given tube usingdifferent 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 submergeand 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).

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B. TECH-MECHANICAL ENGINEERING

Course Code		L	T	P	C
23AHS06	Soft Skills (Common to all Branches)	0	1	2	2
Semester	**II B. Tech II Sem (CE, ME & ECE)**				

Course Objectives:

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

Course Outcomes (CO): Student will be able to

CO1: List out various elements of soft skills L1, L2
CO2: Describe methods for building professional image L1, L2
CO3: Apply critical thinking skills in problem solving L3
CO4: Analyse the needs of an individual and team for well-being L4
CO5: Assess the situation and take necessary decisions. L5
CO6: Create a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being. L6

UNIT I **Soft Skills & Communication Skills**

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

Activities:
Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity.
(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)
Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.
Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.
Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation, Types of Non-verbal Communication - Controlling nervousness

UNIT II **Critical Thinking**

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

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

UNIT III **Problem Solving & Decision Making**

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

Activities:
Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and

initiate debate on the appropriateness of the decision. Case Study & Group Discussion.

UNIT IV	**Emotional Intelligence & Stress Management**

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

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

UNIT V	**Corporate Etiquette**

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

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

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

Learning Resources:

Textbooks:

1. Mitra Barun K, *Personality Development and Soft Skills*, Oxford University Press, Pap/Cdr edition 2012
2. Sharma, Sangeeta & Mishra, Binod, *Communication Skills for Engineers & Scientists*, 2nd Edn. PHI 2023

Reference Books:

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

Web Resources:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (AUTONOMOUS)
KALIKIRI-517234, ANNAMAYYA (Dt.)., A.P., INDIA.

B. TECH-MECHANICAL ENGINEERING

Course Code	Design Thinking for Innovation (common to all Branches)	L	T	P	C
		1	0	2	2
23AHSS3	Semester : II B.Tech II Semester				

Course Objectives:

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

Course Outcomes (CO): **Blooms Level**

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

UNIT - I	Introduction to Design Thinking	10 Hrs

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 Hrs

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, brain storming, 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	8 Hrs

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	8 Hrs

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 Hrs

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

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

Textbooks:

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

Reference Books:

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

Online Learning Resources:

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