B.Tech R23 - COURSE STRUCTURE AND SYLLABI

B.Tech.– II Year I Semester

S. No	Course Code	Course Title	Scheme of Instructions Hours per Week			
			L	T	P	C
1	23BST09	Numerical Methods and Transform Techniques	3	-	-	3
2	23BST12	Universal Human Values – Understanding Harmony and Ethical Human Conduct	2	1	-	3
3	**23MET06**	**Material Science and Metallurgy**	**3**	**-**	**-**	**3**
4	**23MET05**	**Mechanics of Solids**	**3**	**-**	**-**	**3**
5	**23MET04**	**Thermodynamics**	**2**	**-**	**-**	**2**
6	**23MEP03**	**Mechanics of Solids and Materials Science Lab**	**-**	**-**	**3**	**1.5**
7	**23MEP04**	**Computer-Aided Machine Drawing**	**-**	**-**	**3**	**1.5**
8	23ECP03	Embedded Systems and IoT Lab	-	-	2	1
9	23CSP06	Python Programming	-	1	2	2
10	23BST13	Environmental Science	2	-	-	-
		Total	15	02	10	20

B.Tech. II Year II Semester

S. No	Course Code	Course Title	Scheme of Instructions Hours per Week			
			L	T	P	C
1	23MBTU3	Industrial Management	2	-	-	2
2	23BST14	Complex Variables, Probability and Statistics	3	-	-	3
3	**23MET07**	**Manufacturing Processes**	**3**	**-**	**-**	**3**
4	**23MET08**	**Fluid Mechanics and Hydraulic Machines**	**3**	**-**	**-**	**3**
5	**23MET09**	**Kinematics of Machines**	**3**	**-**	**-**	**3**
6	**23MEP05**	**Fluid Mechanics and Hydraulic Machines Lab**	**-**	**-**	**3**	**1.5**
7	**23MEP06**	**Manufacturing Processes Lab**	**-**	**-**	**3**	**1.5**
8	23BSP07	Soft Skills	-	1	2	2
9	23MBTU2	Design Thinking and Innovation	1	-	2	2
		Total	15	1	10	21
Mandatory Community Service Project Internship of 06 – 08 weeks duration during summer vacation						

II Year B.Tech. ME – I Semester

Course Code	NUMERICAL METHODS & TRANSFORM TECHNIQUES	L	T	P	C
23BST09		3	0	0	3

Course Outcomes:

COs	Statements	Blooms level
CO1	Apply numerical methods to solve algebraic and transcendental equations	L3
CO2	Derive interpolating polynomials using interpolation formulae	L3
CO3	Solve differential and integral equations numerically	L3
CO4	Evaluate the Fourier series expansion of periodic functions.	L5
CO5	Understand the use of Fourier transforms and apply z transforms to solve differenceequations.	L2

UNIT I Solution of Algebraic & Transcendental Equations

Introduction – Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method System of Algebraic equations: Successive over relation method

UNITII Interpolation

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

UNIT III Solution of Initial value problems to Ordinary differential equations

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

UNIT IV Fourier series

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

UNIT V Fourier transforms and Z-Transforms

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

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

Textbooks:

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

Reference Books:

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

Online Learning Resources:

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

II Year B.Tech. ME – I Semester

Course Code	UNIVERSAL HUMAN VALUES – Understanding Harmony and Ethical Human Conduct	L	T	P	C
23BST12		2	1	0	3

Course Objectives:

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

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

Course Topics

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

READINGS:

Textbook and Teachers Manual

a. The Textbook

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

b. The Teacher's Manual

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

Reference Books

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

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

Mode of Conduct:

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

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

Online Resources

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

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

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

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

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

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

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

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

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

II Year B.Tech. ME – I Semester

Course Code	MATERIAL SCIENCE & METALLURGY	L	T	P	C
23MET06		3	0	0	3

PRE-REQUISITES: Engineering Physics

COURSE EDUCATIONAL OBJECTIVES:

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

Course Outcomes:

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

UNIT –1: CONSTITUTION OF ALLOYS AND EQUILIBRIUM DIAGRAMS (9)

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 grainsize – Imperfections – Slip and Twinning. Necessity of alloying – Types of solid solutions – Hume Rothery's rules – intermediate alloy phases – 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 –2: FERROUS METALS, NON-FERROUS METALS AND ALLOYS (9)

Ferrous Metals and Alloys: Structure, properties and application of White Cast iron – Malleable Cast iron – Grey cast iron – Spheroidal graphite cast iron – Alloy cast iron.

Steels: Classification of Steels – Structure and properties of plain carbon steels – Low alloy steels – Hadfield manganese steels – Stainless steels – Tool and die steels.

Non-Ferrous Metals and Alloys: Structure, properties and applications of copper and its alloys – Aluminum and its alloys – Titanium and its alloys – Magnesium and its alloys – Super alloys.

UNIT –3: HEAT TREATMENT OF STEELS (9)

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 –4: POWDER METALLURGY (9)

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 –5: CERAMICS AND ADVANCED MATERIALS (9)

Ceramics: Crystalline ceramics – Glasses – Cermets – Abrasive materials.

Composite: Classification of composites – Manufacturing methods – Particle reinforced composites – Fiber reinforced composites – PMC – MMC – CMC – CCCs – Introduction to Nanomaterials and smart materials.

Total Hours: 45

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Dr.V.D.kodgire, Material Science and Metallurgy, 39/e, Everest Publishing House, 2017.
2. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
3. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley and Sons, 2009.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.
5. Yip-Wah Chung, Introduction to Material Science and Engineering, 2/e, CRC Press, 2022.
6. A V K Suryanarayana, Material Science and Metallurgy, B S Publications, 2014.
7. U. C. Jindal, Material Science and Metallurgy, 1/e, Pearson Publications, 2011.
8. Elements of Material Science and Engineering, Lawrence H.Vanvlack, 6/e, 2002, Pearson Education, New Delhi.

REFERENCE WEBSITE:

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

II Year B.Tech. ME – I Semester

Course Code	MECHANICS OF SOLIDS	L	T	P	C
23MET05		3	0	0	3

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

1. Understand the behavior of basic structural members subjected to uniaxial and bi axial loads.
2. Apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
3. Students will earn 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. Students are able to analyze beams and draw correct and complete shear and bending moment diagrams for beams.
4. Students attain a deep understanding into the loads, stresses, and strains acting on a structure and the irrelations in the elastic behavior
5. Design and analysis of Industrial components like pressure vessels.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design 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 behavior of basic structural members subjected to variousloads	L4
CO5	Design and analysis of Industrial components like pressure vessels.	L6

UNIT –1: SIMPLE STRESSES AND STRAINS (9)

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 –2: SHEAR FORCE AND BENDING MOMENT (9)

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, UDL, 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 a beam.

UNIT –3: FLEXURAL STRESSES AND SHEAR STRESSES (9)

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 –4: DEFLECTION OF BEAMS AND TORSION (9)

Deflection of Beams: Bending into a circular arc – Slope, deflection and radius ofcurvature – 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 –5: THIN, THICK CYLINDERS AND COLUMNS (9)

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 and 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.

Total Hours: 45

TEXT BOOKS:

1. Dr.B.C.Punmia, Dr.Arun Kumar Jain, Er.Ashok Kumar Jain, "Mechanics of Materials", Laxmi Publications (P) Ltd., New Delhi, 12/e, 2017.
2. S. Ramamrutham and R.Narayanan, "Strength of Materials", DhanpatRai Publishing Company (P) Ltd., New Delhi, 20/e, 2020.
3. GH Ryder,Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.

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.
6. R.C.Hibbeler, "Mechanics of Materials", Pearson Education, New Delhi, 9/e, 2018.
7. Ferdinand P. Beer, E. Russell Johnston Jr., John T. DeWolf, David F. Mazurek, Sanjeev Sanghi, "Mechanics of Materials", McGraw-Hill Education Pvt. Ltd., Noida, 8/e, 2020.

REFERENCE WEBSITE:

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
7. mechanical-behavior-of-materials-part-1-linear-elastic-behavior
8. https://archive.nptel.ac.in/courses/112/107/112107146

II Year B.Tech. ME – I Semester

Course Code	THERMODYNAMICS	L	T	P	C
23MET04		2	0	0	2

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

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

Course Outcomes:

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

UNIT –1: BASIC CONCEPT OF THERMODYNAMICS (9)

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 –2: FIRST LAW OF THERMODYNAMICS (9)

Energy in State and in Transition, Types, Work and Heat – Point and Path function – Zeroeth Law of Thermodynamics - PMM-I, Joule's Experiment.

First law of Thermodynamics and applications – Limitations of the First Law – Enthalpy – Thermal Reservoir – Heat Engine – Heat pump – Parameters of performance.

UNIT –3: SECOND LAW OF THERMODYNAMICS AND THERMODYNAMIC RELATIONS (9)

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 – Clausius - Clapeyron Equation Elementary Treatment of the Third Law of Thermodynamics.

UNIT –4: PROPERTIES OF PURE SUBSTANCES AND POWER CYCLES (9)

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.

Air Power cycles: Assumptions and working of Otto and Diesel cycles – Comparison of air standard and actual cycles.

Vapour Power Cycles: Rankine cycle – Schematic layout.

UNIT –5: INTRODUCTION TO REFRIGERATION AND AIR CONDITIONING (9)

Introduction to Refrigeration: Working of Air, Vapour compression and vapour absorption refrigeration system – VCR and VAR system Components – COP – Refrigerants.

Introduction to Air Conditioning: Psychrometric properties & processes – Characterization of sensible and latent heat loads – Load concepts of SHF – Requirements of human comfort and concept of effective temperature – Comfort chart comfort air conditioning, and load calculations.

TEXT BOOKS:

1. P.K.Nag, "Engineering Thermodynamics", Tata McGraw-Hill Education Pvt. Ltd., 6/e, 2017.
2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 10/e, Wiley, 2020.

REFERENCE BOOKS:

1. Yunus Cengel and Boles, "Thermodynamics-An Engineering Approach", Tata McGraw-Hill Education Pvt. Ltd., 9/e, 2019.
2. J.B. Jones, and R.E. Dugan, Engineering Thermodynamics, 1/e,Prentice Hall, 1996.
3. P.Chattopadhyay, Engineering Thermodynamics, 2/e, Oxford University Press, 2016.
4. CP Arora, Refrigeration and Air-conditioning, 4/e, McGraw Hill, 2021.
5. P.K.Nag, Basic and Applied Thermodynamics", Tata McGraw-Hill Education Pvt. Ltd., 2/e, 2017.

Note: Use of standard thermodynamic tables, Mollier diagram and Psychrometric chart are permitted.

REFERENCE WEBSITE:

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://www.coursera.org/learn/thermodynamics-intro
5. https://swayam.gov.in/nd1_noc19_me56/preview
6. https://www.classcentral.com/course/nptel-engineering-thermodynamics-7904
7. https://www.edx.org/course/thermodynamics-2
8. https://www.courses.com/indian-institute-of-technology-kharagpur/basic-thermodynamics

II Year B.Tech. ME – I Semester

Course Code	MECHANICS OF SOLIDS & MATERIAL SCIENCE LAB	L	T	P	C
23MEP03		0	0	3	1.5

PRE-REQUISITES: Nil.

COURSE EDUCATIONAL OBJECTIVES:

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

Course Outcomes:

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

List of Experiments: MECHANICS OF SOLIDS

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
9. Compression Test
10. Tension, compression, shear and bending test using electronic tenso meter

List of Experiments: MATERIAL SCIENCE

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

REFERENCE WEBSITE:

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

II Year B.Tech. ME – I Semester

Course Code	COMPUTER-AIDED MACHINE DRAWING	L	T	P	C
23MEP04		0	0	3	1.5

PRE-REQUISITES: Knowledge in Engineering Drawing, Basics of AutoCAD

COURSE EDUCATIONAL OBJECTIVES:

1. Make the students to understand conventional representations of material and interpret drawings of machine components.
2. Familiarize with thread profiles, riveted, welded and key joints
3. Train to use software for 2D and 3D modeling.
4. To prepare assembly drawings using standard CAD packages.
5. To familiarize the students with limits, fits, and tolerances in mating components

Course Outcomes:

COs	Statements	Blooms Level
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 EXERCISES:

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

1. **Conventional representation of materials and components**
2. **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.
3. **Riveted joints:** Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.
4. **Welded joints:** Lap joint and T joint with fillet, butt joint with conventions.
5. **Keys:** Taper key, sunk taper key, round key, saddle key, feather key, woodruff key
6. **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

7. **Sectional views:** Creating solid models of machine parts and sectional views.
8. **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, sleeve and cotter joint and Knuckle joint.

9. **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.

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.

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.

REFERENCE WEBSITE:

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

II Year B.Tech. ME – I Semester

Course Code	EMBEDDED SYSTEMS & IoT	L	T	P	C
23ECP03		0	0	2	1
Semester				III	

Course Objectives:

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

Course Outcomes:

COs Statements Blooms Level

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

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

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

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

Text Books:

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

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

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

II Year B.Tech. ME – I Semester

Course Code	PYTHON PROGRAMMING (SKILL ENHANCEMENT COURSE)	L	T	P	C
23CSP06		0	1	2	2

COURSE OBJECTIVES:

The main objectives of the course are to
- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming

and to create practical and contemporary applications using these

COURSE OUTCOMES

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

UNTI-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.
Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.
Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.
Sample Experiments:
1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
i) Arithmetic Operators ii) Relational Operators iii) Assignment Operatorsiv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

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

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

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.
Sample Experiments:
13. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
14. Write a program to count the number of vowels in a string (No control flow allowed).
15. Write a program to check if a given key exists in a dictionary or not.
16. Write a program to add a new key-value pair to an existing dictionary.
17. Write a program to sum all the items in a given dictionary.

UNIT-IV:Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.
Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.
<Sample Experiments:
18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in the array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

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

attribute with respect to other attribute with scatter and plot operations in matplotlib
Reference Books:
1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press. 2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024 3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.
Online Learning Resources: 1. https://www.coursera.org/learn/python-for-applied-data-science-ai 2. https://www.coursera.org/learn/python?specialization=python#syllabus

II Year B.Tech. ME – I Semester

Course Code: 23BST13	Environmental Science (Common to All Branches of Engineering)		L	T	P	C
			3	0	0	0
Pre-requisite	NIL	Semester	III			

CourseObjectives:

- 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

CourseOutcomes(CO):

CO 1: Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources
CO 2: Understand flow and bio-geo- chemical cycles and ecological pyramids.
CO 3: Understand various causes of pollution and solid waste management and related preventive measures.
CO 4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
CO 5: Casus of population explosion, value education and welfare programmes.

UNIT-I	Multidisciplinary Nature of Environmental Studies and Natural Resources:	8Hrs

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

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

UNIT–II	Ecosystems and Biodiversity AndBiodiversity And Its Conservation	8Hrs

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 and Solid Waste Management:	8Hrs

Environmental Pollution: Definition, Cause, effects and control measures of : a. Air Pollution. b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. nuclear hazards **Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT-IV	Social Issues And the Environment	10 Hrs

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

UNIT-V	Human Population And the Environment	8 Hrs

Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies. Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:

TEXT BOOKS:

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

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.

MOE 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 or the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life. Depending on the nature of topics, worksheets, homeassignmentsand/oractivitiesareincluded.Thepracticesessions(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.

II Year B.Tech. ME – II Semester

Course Code	INDUSTRIAL MANAGEMENT	L	T	P	C
23MBTU3		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES: The objectives of the course are to

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

Course Outcomes:

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

UNIT –1: INDUSTRIAL ENGINEERING AND PLANT LAYOUT (9)

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

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

UNIT –2: WORK STUDY (9)

Work and Method study: Ergonomics principles – Process chart symbols – Flow process, activity chart, flow and string diagram – Operation analysis and motion economy – Design and layout of work place – Therbligs – SIMO chart – Time study – Standard data – Analytical estimating – Performance Rating – Allowances – PMTS.

Industrial Psychology: Concept, individuals and group – Motivation theories – Hawthorne experiment – Morale and motivation – Environmental condition – Industrial fatigue.

UNIT –3: STATISTICAL QUALITY CONTROL AND TQM (9)

Statistical Quality Control: Control chart for attributes – Control chart for non-conforming – p chart and np chart – Control chart for nonconformities: C and U charts – Control chart for variables: X chart, R chart and σ chart – State of control and process out of controlidentification in charts, pattern study and process capability studies.

Total Quality Management: Elements of TQM – Continuous Improvement zero defectconcept, quality circles, 5S, FMEA, TPM, QFD, Seven tools, bench marking, PDSA, leadership, implementation, applications, ISO quality systems. Six Sigma definition, basic concepts.

UNIT –4: PRINCIPLES OF MANAGEMENT AND FINANCIAL MANAGEMENT (9)

Principles of Management: Basic principles of planning, decision making, organizing, directing, controlling and coordinating.

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 –5: HUMAN RESOURCE MANAGEMENT AND VALUE ANALYSIS (9)

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.

Total Hours: 45

TEXT BOOKS:

1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications(P)Ltd.
2. Martand Telsang, Industrial Engineering and Production Management, S. Chand & CompanyLtd. 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,IndustrialEngineeringandManagementScience, KhannaPublishers.
4. Koontz O'Donnell, Principles of Management, McGraw Hill Publishers.
5. R.C.Gupta, Statistical Quality Control, Khanna Publishers.
6. NVS Raju, Industrial Engineering and Management, Cengage India Private Limited.

REFERENCE WEBSITE:

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

II Year B.Tech. ME – II Semester

Course Code	COMPLEX VARIABLES, PROBABILITY AND STATISTICS	L	T	P	C
23BST14		3	0	0	3

Course Outcomes:

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

UNITI: Complex Variable– Differentiation

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

UNIT- II: Complex Variable–Integration

Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of Integrals of the form $\int_{-\infty}^{\infty} f(x)dx$.

UNIT- III: Probability theory

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

UNIT-IV: Random variables &Distributions

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

UNIT-V: Estimation and Testing of hypothesis, large sample tests

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

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition
2. Miller and Freunds, Probability and StatisticsforEngineers,7/e, Pearson, 2008.

Reference Books:

1. R.K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd.,20215th Edition (9th reprint).
2. B.V. Ramana, Higher Engineering Mathematics, Mc Graw Hill publishers
3. W. Feller, an Introduction to Probability Theory and its Applications,1/e, Wiley, 1968.

Online Learning Resources:

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

II Year B.Tech. ME – II Semester

Course Code	MANUFACTURING PROCESSES	L	T	P	C
23MET07		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES: The objectives of the course are to

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

Course Outcomes:

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

UNIT –1: CASTING (9)

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, Diecasting, Investment casting and shell molding.

UNIT –2: WELDING (9)

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.

UNIT –3: Bulk & Sheet Metal Forming (9)

Bulk Forming: Plastic deformation in metals and alloys-recovery, recrystallization and grain growth. Hot working, Cold working -Strain hardening and Annealing. 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.

Sheet Metal Forming: 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.

UNIT –4: Plastic & Ceramic Processing (9)

Plastics: Types, properties and their applications, processing of plastics, extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding, and blow molding.

Ceramics: Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramic Coatings, finishing - PVD - CVD - PECVD - Thermal Spray - Electroless Deposition - Electroplating - Laser coatings

UNIT –5: ADDITIVE MANUFACTURING (9)

Additive manufacturing – Steps in Additive Manufacturing (AM) – Classification of AM Processes – Advantages of AM – Types of materials for AM – VAT photo polymerization AM Processes – Extrusion Based AM Processes – Powder Bed Fusion AM Processes – Direct EnergyDeposition AM Processes – Post Processing of AM Parts – Applications.

Total Hours: 45

TEXT BOOKS:

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.

REFERENCE WEBSITE:

1. https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technologyfundamentals-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/

II Year B.Tech. ME – II Semester

Course Code	FLUID MECHANICS & HYDRAULIC MACHINES	L	T	P	C
23MET08		3	0	0	3

PRE-REQUISITES:

COURSE EDUCATIONAL OBJECTIVES: The students completing this course are expected to

1. Understand the properties of fluids, manometry, hydrostatic forces acting on different surfaces
2. Understand the kinematic and dynamic behavior through various laws of fluids like continuity,Euler's, Bernoulli's equations, energy and momentum equations.
3. Understand the theory of boundary layer and dimensional analysis.
4. To understand the importance of various types flow in turbines
5. To understand the importance of various types flow in pumps

Course Outcomes:

COs	Statements	Blooms Level
CO1	Understand the basic concepts of fluid properties.	L2
CO2	Estimate the mechanics of fluids in static and dynamic conditions.	L5
CO3	Apply the Boundary 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 –1: FLUID STATICS, BUOYANCY AND FLOATATION (9)

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 –2: FLUID KINEMATICS, DYNAMICS AND CLOSED CONDUIT FLOW (9)

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 streamline, momentum equation and its applications, force on pipe bend.

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.

UNIT –3: BOUNDARY LAYER THEORY AND DIMENSIONAL ANALYSIS (9)

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 PiTheorem.

UNIT –4: BASICS OF TURBO MACHINERY AND HYDRAULIC TURBINES (9)

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 andreaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design – draft tube- theory-functions and efficiency.

UNIT –5: TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS (9)

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.

Total Hours: 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

REFERENCE WEBSITE:

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

II Year B.Tech. ME – II Semester

Course Code	KINEMATICS OF MACHINES	L	T	P	C
23MET09		3	0	0	3

PRE-REQUISITES: A Course on Engineering Mechanics.

COURSE EDUCATIONAL OBJECTIVES:

1. To understand the basic components and layout of linkages in the assembly of a system machine. To study the applications of the conservation laws to flow through pipes.
2. To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
3. To understand the motion resulting from a specified set of linkages, design few linkage mechanisms.
4. To understand the basic concepts cam mechanisms for specified output motions.
5. To understand the basic concepts of toothed gearing and kinematics of gear trains.

Course Outcomes:

COs	Statements	Blooms Level
CO1	Build up critical thinking and problem-solving capacity of various mechanical engineering problems related to kinematics of machines, Analyze various gear trains	L4
CO2	Understand the basic principles of mechanisms in mechanical engineering	L1
CO3	Assess various concepts of mechanisms like straight line motion mechanisms, Steering gear mechanisms and working principles of power elements (Gears, gear trains, Cams) and design related problems effectively	L6
CO4	Examine the velocity and acceleration diagram for a given mechanism and Construction of the cam profile for a given motion	L3
CO5	Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective design	L3

UNIT –1: BASICS OF MECHANISMS (9)

Basics of kinematics – Types of motions – Kinematic links – Kinematic pairs – Kinematic chain – Types of joints in chains – Degree's of freedom – Application of plane mechanism – Inversion of mechanism – Inversions of quadric, single and double slider.

Straight Line Motion Mechanisms: Exact and approximate copiers and generated types – Peaucellier, Hart's and Scott-Russell's mechanism – Grasshopper mechanism – Watt's-modified Scott- Russell mechanism – T.Chebicheff's and Robert mechanism – Pantograph.

UNIT –2: KINEMATICS OF LINKAGE MECHANISMS (9)

Instantaneous Centre Method: Instantaneous center of rotation, centroids and axodes – Relative motion between two bodies – Three centers in-line theorem – Locating instantaneous centers for simple mechanisms and determination of angular velocity.

Relative Velocity Method: Velocity and acceleration – Motion of link in machine – Determination of velocity and acceleration diagrams – Graphical method - Application of relative velocity method – Slider crank mechanism – Four bar mechanism.

Acceleration Method: Acceleration diagrams for simple mechanisms, Coriolis component of acceleration and its determination – Kleins construction – Analysis of slider crank mechanism for displacement, velocity and acceleration.

UNIT –3: STEERING MECHANISMS AND DRIVE SYSTEM (9)

Steering Mechanisms: Conditions for correct steering – Davis steering gear – Ackerman's steering gear – Velocity ratio – Universal joint – Single and double Universal joint.

Drive Systems: Belt, Rope and chain drives – Selection of belt drive – Types of belt drives – Materials used for belts and ropes – Velocity ratio of belt drives, slip of belt, creep of belt, tension for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt. **Chains**: Length, angular speed ratio – Classification of chains (theory only).

UNIT –4: KINEMATICS OF CAM (9)

Classification of cams and followers – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions –Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angleand undercutting – sizing of cams.

UNIT –5: GEARS AND GEAR TRAINS (9)

Gearing: Law of toothed gearing – Involutes and cycloidal tooth profiles – Spur gear terminology – Gear tooth action – Contact ratio – Interference and undercutting – Helical, bevel, worm, rack and pinion gears.

Gear trains: Gear trains – Speed ratio – Train value – Simple gear train – Compound and reverted gear train – Epicyclic gear trains – Differentials.

Total Hours: 45

TEXT BOOKS:

1. S. S. Rattan, "Theory of Machines and Mechanisms", Tata McGraw-Hill EducationPvt. Ltd, Noida, 5/e, 2019.
2. Robert L Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill Education Pvt. Ltd, 1/e, 2009.
3. Theory of machines – PL. Balaney / Khanna publishers

REFERENCE BOOKS:

1. John J. Uicker Jr, Gordon R. Pennock & Joseph E. Shigley, "Theory of Machines and Mechanisms", SI Edition, Oxford University Press, 3/e, 2009.
2. Thomas Bevan, "Theory of Machines", Pearson Education, New Delhi, 3/e, 2009.
3. Sadhu Singh, "Theory of Machines", Pearson Education, New Delhi, 3/e, 2011.
4. R.S Khurmi and J.K Gupta, "Theory of Machines", S. Chand & Company Pvt. Ltd. New Delhi, 14/e, 2013.
5. Amitabha Ghosh and Asok Kumar Mallik, "Theory of Mechanisms and Machines", East-West Press Pvt Ltd., 3/e, 2008.
6. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age.

REFERENCE WEBSITE:

1. http://nptel.ac.in/courses/112/104/112104121/
2. https://nptel.ac.in/courses/112/105/112105268/
3. https://nptel.ac.in/courses/112/106/112106270/

II Year B.Tech. ME – II Semester

Course Code	FLUID MECHANICS & HYDRAULIC MACHINERY LAB	L	T	P	C
23MEP05		0	0	3	1.5

COURSE OBJECTIVES:

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

Course Outcomes:

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

List of Experiments

1. Impact 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 Orificemeter.
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.

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-FluidLaboratory/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://fmnitk.vlabs.ac.in/exp/impact-of-jet).
7. To determine friction in pipes. (https://fm-nitk.vlabs.ac.in/exp/friction-inpipes/index.html).

Reference Books:

1. P N Modi and S M Seth, Hydraulics & Fluid Mechanics including Hydraulics Machines, Standard Book House, 2017.
2. RK Bansal, 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.RamaDurgaiah,FluidMechanicsandMachinery,1/e, NewAgeInte

REFERENCE WEBSITE:

1. https://nptel.ac.in/courses/112/104/112104301/
2. https://nptel.ac.in/courses/112/107/112107219/

II Year B.Tech. ME – II Semester

Course Code	MANUFACTURING PROCESSES LAB	L	T	P	C
23MEP06		0	0	3	1.5

COURSE EDUCATIONAL OBJECTIVES:

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

Course Outcomes:

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

Trade for Exercises:

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)
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. Demonstration of Additive Manufacturing processes.
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-processdei/theory.html)
2. To weld and cut metals using an oxyacetylene welding setup. (https://virtuallabs.github.io/exp-gas-cutting-processes-iitkgp/index.html).
3. To simulate Fused deposition modelling process (FDM) (https://3dpdei.vlabs.ac.in/exp/simulation-modelling-process)
4. https://altair.com/inspire-mold/
5. https://virtual-labs.github.io/exp-simulation-cartesian-system-dei/theory.html

II Year B.Tech. ME – II Semester

Course Code	SOFT SKILLS	L	T	P	C
23BSP07		0	1	2	2

Course Objectives:

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

Course Outcomes

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

UNIT I Soft Skills & Communication Skills

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

Activities:

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

UNIT II Critical Thinking

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

Activities:

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

UNIT III Problem Solving & Decision Making

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

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

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

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

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

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

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

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

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

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

Online Learning Resources:

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

II Year B.Tech. ME – II Semester

Course Code	DESIGN THINKING & INNOVATION (Common to All branches of Engineering)	L	T	P	C
23MBTU2		1	0	2	2
	Semester	IV			

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): Student will be able to

- 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	Lecture Hrs: 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	Lecture Hrs: 12

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	LectureHrs:12

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	LectureHrs:12

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	LectureHrs:12

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes. Activity: How to market our own product, About maintenance, Reliability and plan for startup.
Textbooks:
1. Tim Brown, Change by design, Harper Bollins (2009) 2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.
Reference Books:
1. David Lee, Design Thinking in the Classroom, Ulysses press 2. Shrutin N Shetty, Design the Future, Norton Press 3. William Lidwell, Universal Principles of Design- Kritinaholden, Jill Butter. 4. Chesbrough.H, The Era of Open Innovation – 2013
Online Learning Resources:
https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://swayam.gov.in/nd1_noc19_mg60/preview