II B.TECH - I SEMESTER

S. No	Subject	Course Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Numerical Methods and Transform Techniques	R23CC2110	BS	30	70	100	3	0	0	3
2	Universal Human Values– Understanding Harmony& Ethical Human Conduct	R23CC2102	HSMC	30	70	100	2	1	0	3
3	Thermo dynamics	R23ME2103	ES	30	70	100	2	0	0	2
4	Mechanics of Solids	R23ME2104	PC	30	70	100	3	0	0	3
5	Material Science and Metallurgy	R23ME2105	PC	30	70	100	3	0	0	3
6	Mechanics of Solids and Materials Science Lab	R23ME21L1	PC	30	70	100	0	0	3	1.5
7	Computer-aided Machine Drawing	R23ME21L2	PC	30	70	100	0	0	3	1.5
8	Python programming Lab	R23ME21L3	ES	30	70	100	0	0	2	1.0
9	Embedded Systems & IoT	R23ME21L4	SC	30	70	100	0	1	2	2
10	Environmental Studies	R23CC21MC	MC	30	70	100	2	0	0	-
Total							**15**	**2**	**10**	**20**

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: **R23CC2110**	**NUMERICAL METHODS AND TRANSFORM TECHNIQUES**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Evaluate the approximate roots of polynomial and transcendental equations by different algorithms.

CO2: Apply numerical integral techniques to different Engineering problems. Apply different Algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations

CO3: Apply the Laplace transform for solving differential equations

CO4: Analyze the Fourier series of periodic signals

CO5: Apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms

UNIT – I

ITERATIVE METHODS:

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

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

UNIT – II

NUMERICAL INTEGRATION, SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS WITH INITIAL CONDITIONS:

Trapezoidal rule, Simpson's 1/3rd and 3/8th rule, Solution of initial value problems by Taylor's series, Picard's method of successive approximations, Euler's method , Runge- Kutta method (second and fourth order), Milne's Predictor and Corrector Method.

UNIT –III

LAPLACE TRANSFORMS:

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

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

UNIT – IV

FOURIER SERIES:

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

UNIT – V

FOURIER TRANSFORMS:

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	1	0	30	70	100	3
Code: **R23CC2102**	**UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY& ETHICAL HUMAN CONDUCT**						

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:

CO1: Interpret the terms like Natural Acceptance, Happiness and Prosperity
CO2: Identify one's self, and one's surroundings (family, society nature)
CO3: Apply what they have learnt to their own self in different day-to-day settings in real life
CO4: Relate human values with human relationship and human society.
CO5: Justify the need for universal human values and harmonious existence
CO6: Develop as socially and ecologically responsible engineers

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
Lecture 4: 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. Jeevan Vidya: E k Parichaya, A Nagaraj, Jeevan Vidya Prakashan, 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 Karam chand 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 – Pandit Sunderlal
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
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0	30	70	100	2
Code: **R23ME2103**	**THERMO DYNAMICS**						

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:

After successful completion of this course, the students will be able to:

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

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, First law for flow systems - Steady flow energy equation – 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

Introduction to Refrigeration: working of Air, Vapor Compression, VCR 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, 6/e, Tata McGraw Hill, 2017.
2. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 10/e, Wiley, 2020.

REFERENCE BOOKS:

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

ONLINE LEARNING 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_3rdSemester_Winter_2021_Mechanical-Engg.-_Thermal-Engineering-1_Abhijit Samant.pdf
- https://www.coursera.org/learn/thermodynamics-intro

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: **R23ME2104**	**MECHANICS OF SOLIDS**						

COURSE OBJECTIVES:

The objectives of the course are to

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: **Analyze** concepts of stress and strain, Elasticity and plasticity, Bars of varying section, composite bars, Temperature stresses, Principal planes and principal stresses, Mohr's circle.

CO2: **Analyze** beams and draw shear force diagrams and bending moment diagrams to the different loads for the different support arrangements.

CO3: **Determine** flexural stresses and shear stresses induced in the beams which are made with different cross sections like rectangular, circular, I and T sections.

CO4: **Evaluate** the equations of slope and deflection for beams by using double integration method, Macaulay's method, Mohr's theorem and Moment area method.

CO5: **Determine** stresses induced in thin and thick cylinders subjected to internal, external pressures for longitudinal and circumferential stresses.

UNIT– I

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 uniaxial and biaxial stress conditions - Principal planes and principal stresses - Mohr's circle - Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT–II

SHEAR FORCE AND BENDING MOMENT: 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.

UNIT–III

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 : 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: 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. Lame's equation – cylinders subjected to inside & outside pressures.

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

TEXT BOOKS:

1. GH Ryder, Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.
2. B.C. Punmia, Strength of materials, 10/e, Lakshmi publications Pvt. Ltd, New Delhi, 2018.

REFERENCE BOOKS:

1. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.
2. U.C. Jindal, Strength of Materials, 2/e, Pearson Education, 2017.
3. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
4. Andrew Pytel and Ferdinand L. Singer, Strength of Materials, 4/e, Longman Publications, 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/

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: **R23ME2105**	**MATERIAL SCIENCE & METALLURGY**						

COURSE OBJECTIVE:

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

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

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

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

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

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

UNIT– I

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

UNIT–II

FERROUS METALS AND ALLOYS: 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, Aluminum and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT–III

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

TEXT BOOKS:

1. S.H.Avner, Introduction to Physical Metallurgy, 3/e, Tata McGraw- Hill, 2017.
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.

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.

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	30	70	100	1.5
Code: **R23ME21L1**	**MECHANICS OF SOLIDS & MATERIALS SCIENCE LAB**						

COURSE OBJECTIVE:

- 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 nonferrous alloy specimens.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Analyze the stress, strain behavior of different materials.
CO2: Evaluate the hardness of different materials.
CO3: Compare the relation between elastic constants and hardness of materials.
CO4: Identify various microstructures of steels and cast irons.
CO5: Evaluate hardness of treated and untreated steels.

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

A) MECHANICS OF SOLIDS LAB:

1. Tensile test
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
   a) Brinell's hardness test
   b) Rockwell hardness test
   c) Vickers hardness test
5. Test on springs
6. Impact test
   a) Charpy test
   b) Izod test
7. Magnetic Particle Testing
8. Liquid penetration test

B) MATERIAL SCIENCE LAB:

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

VIRTUAL LAB:

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

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	30	70	100	1.5
Code: **R23ME21L2**	**COMPUTER-AIDED MACHINE DRAWING**						

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:

After successful completion of this course, the students will be able to:

CO1: Utilize the conventional representations of materials and machine components.
CO2: Model the riveted, welded and key joints using CAD system.
CO3: Model the solid models and sectional views of machine components by using 3D software package.
CO4: Model the solid models of machine parts and assemble them by using 3D software package.
CO5: Analyze the limits, fits and tolerances for mating parts and prepare manufacturing drawing

THE FOLLOWING ARE TO BE DONE BY ANY 2D SOFTWARE PACKAGE

Conventional representation of materials and components:

Detachable joints:

Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

Riveted joints:

Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints:

Lap joint and T joint with fillet, butt joint with conventions.

Keys:

Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Couplings:

Rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's' coupling.

THE FOLLOWING EXERCISES ARE TO BE DONE BY ANY 3D SOFTWARE PACKAGE:

Sectional views:

Creating solid models of complex machine parts and sectional views.

Assembly drawings :(Any four of the following using solid model software)

Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, 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.

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.

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

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	2	30	70	100	1.0
Code: **R23ME21L3**	**PYTHON PROGRAMMING LAB**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Develop a solid foundation in Python programming, covering essential syntax, semantics, and constructs.
CO2: Analyze data using Python libraries like Pandas and NumPy.
CO3: Develop various algorithms and data structures in Python.
CO4: Develop skills, including version control, package management, and project documentation.
CO5: Analyze web scraping, API interaction, and database management.

Experiment 1: Introduction to Python
Objective: Install Python and set up the development environment.
Tasks:
- Install Python and an IDE (e.g., PyCharm, VSCode, or Jupyter Notebook).
- Write and run a simple "Hello, World!" program.
- Understand and demonstrate basic Python syntax and semantics.

Experiment 2: Basic Python Programming
Objective: Learn basic programming constructs in Python.
Tasks:
- Create programs using variables, data types, and operators.
- Implement basic input and output functions.
- Write programs using control structures (if statements, for loops, while loops).

Experiment 3: Functions and Modules
Objective: Understand functions and module usage in Python.
Tasks:
- Define and call functions with different types of arguments and return values.
- Explore and use built-in Python modules.
- Write a script that imports and utilizes at least two different standard library modules.

Experiment 4: Lists and Tuples
Objective: Work with Python lists and tuples.

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

Experiment 5: Dictionaries and Sets
Objective: Explore dictionaries and sets in Python.
Tasks:
- Create and manipulate dictionaries.
- Use dictionary comprehension.
- Create and perform operations on sets.

Experiment 6: Strings and File I/O
Objective: Manipulate strings and perform file I/O operations.
Tasks:
- Demonstrate various string methods.
- Write programs to read from and write to text files.
- Work with different file formats, including CSV and JSON.

Experiment 7: Error Handling and Exceptions
Objective: Implement error handling in Python programs.
Tasks:
- Write programs using try, except, else, and finally blocks.
- Handle specific exceptions.
- Create and raise custom exceptions.

Experiment 8: Object-Oriented Programming (OOP)
Objective: Understand and implement OOP concepts in Python.
Tasks:
- Define classes and create objects.
- Demonstrate inheritance and polymorphism.
- Use class and instance variables in programs.

Experiment 9: Libraries and Packages
Objective: Utilize third-party libraries and create Python packages.
Tasks:
- Install and use libraries like NumPy and Pandas.
- Create a simple Python package and distribute it.
- Work with virtual environments to manage dependencies.

Experiment 10: Working with Data
Objective: Perform data manipulation and visualization.
Tasks:
- Use Pandas to load, manipulate, and analyze datasets.
- Create visualizations using Matplotlib and Seaborn.
- Conduct basic data analysis tasks and summarize findings.

Experiment 11: Web Scraping and APIs
Objective: Extract data from the web and interact with APIs.
Tasks:
- Access and parse data from RESTful APIs.
- Process and analyze JSON data from APIs.

Experiment 12: Databases
Objective: Work with databases in Python.
Tasks:
- Connect to a database using SQLite and SQLAlchemy.
- Perform CRUD operations on the database.
- Write queries to manage and retrieve data.

TEXT BOOKS:

1. Kenneth Lambert, "Fundamentals of Python: First Programs".
2. Allen B. Downey, "think python: how to think like a computer scientist",2nd edition, O'reilly,2016

REFERENCE BOOKS:

1. Python programming: A modern approach, vamsi kurama, pearson.
2. Learning python, Mark Lutz, Orielly.
3. Core python programming, W.Chun, pearson.
4. Introduction to python, Kenneth A. Lambert, Cengage.

ONLINE LEARNING RESOURCES:
1. https://www.udemy.com/course/python-the-complete-python-developercourse/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaign=BGPython_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=_._ag_1220458320107116_._ad__._kw_Python+language_._de_c_._dm__._pl__._ti_kwd-76278984197882%3Aloc90_._li_116074_._pd__._&couponCode=IND21PM
2. https://www.w3schools.com/python/python_intro.asp
3. https://www.youtube.com/watch?v=eWRfhZUzrAc
4. https://onlinecourses.nptel.ac.in/noc20_cs83/preview
5. https://www.edx.org/learn/python
6. Virtual Labs - https://python-iitk.vlabs.ac.in/
7. Virtual Labs - https://virtual-labs.github.io/exp-arithmetic-operations-iitk/
8. Virtual Labs - https://cse02-iiith.vlabs.ac.in/
9. https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manual.pdf

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	1	2	30	70	100	2
Code: **R23ME21L4**	**EMBEDDED SYSTEMS & IOT**						

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:

After successful completion of this course, the students will be able to:

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

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 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 interact 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.
9. Calculate temperature using temperature sensor Using Arduino.
10. Calculate the distance using distance sensor Using Node MCU.
11. Basic LED functionality Using Node MCU.

TEXT BOOKS:

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

ONLINE LEARNING SOURCES

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
3. https://archive.nptel.ac.in/courses/108/105/108105057/
4. https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin- embedded-systems-shape-the-world microcontroller input output? index=product & object ID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2FOutput&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems
5. https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4&linked_from=autocomplete&c=autocomplete
6. https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch
7. Virtual Labs - http://vlabs.iitkgp.ac.in/rtes/
8. Virtual Labs - https://cse02-iiith.vlabs.ac.in/
9. Virtual Labs - https://iotvirtuallab.github.io/vlab/Experiments/index.html

II B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0	30	70	100	-
Code: R23CC21MC	ENVIRONMENTAL STUDIES						

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.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Analyze the natural resources and their importance for the sustenance of the life and recognize the need to conserve the natural resources.

CO2: Explain the concepts of the ecosystem, need, biodiversity and its functions.

CO3: Distinguish various attributes of the pollution, their impacts and measures to reduce or control the pollution along with waste management

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

CO5: Illustrate the causes of population explosion, value education and welfare programmes.

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.

UNIT – II

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

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

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

UNIT – III

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

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution

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

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – 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: 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:

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

REFERENCE BOOKS:

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

ONLINE LEARNING RESOURCES:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and- resources? index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf
- https://www.youtube.com/watch?v=5QxxaVfgQ3k

II B.TECH - II SEMESTER

S. No	Subject	Course Code	Cat. Code	Internal Marks	External Marks	Total Marks	L	T	P	Credits
1	Industrial Management	R23ME2201	HS	30	70	100	2	0	0	2
2	Complex Variables, Probability and Statistics	R23ME2202	BS	30	70	100	3	0	0	3
3	Manufacturing processes	R23ME2203	PC	30	70	100	3	0	0	3
4	Fluid Mechanics & Hydraulic Machines	R23ME2204	PC	30	70	100	3	0	0	3
5	Theory of Machines	R23ME2205	PC	30	70	100	3	0	0	3
6	Fluid Mechanics & Hydraulic Machines Lab	R23ME22L1	PC	30	70	100	0	0	3	1.5
7	Manufacturing processes Lab	R23ME22L2	PC	30	70	100	0	0	3	1.5
8	Soft Skills	R23ME22L4	SC	30	70	100	0	1	2	2
9	Design Thinking & Innovation	R23CC22L3	ES	30	70	100	1	0	2	2
Total							**15**	**1**	**10**	**20**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation										

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0	30	70	100	2
Code: **R23ME2201**	**INDUSTRIAL MANAGEMENT**						

COURSE OBJECTIVES:

The objectives of the course are to

- 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:

After successful completion of this course, the students will be able to:

CO1: **Explain** about how to design the optimal layout
CO2: **Demonstrate** work study methods
CO3: **Explain** Quality Control techniques
CO4: **Discuss** the financial management aspects and
CO5: **Interpret** the human resource management methods.

UNIT– I

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

PLANT LAYOUT: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and break down maintenance.

UNIT–II

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

UNIT–III

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

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

UNIT– IV

FINANCIAL MANAGEMENT: Scope and nature of financial management, Sources of finance, Concept of Capital, Working Capital cycle, Fixed Capital V/s Working Capital, Management of working capital, estimation of working capital requirements, Capital budgeting – Nature of Investment Decisions – Investment Evaluation criteria- NPV, IRR, PI, Payback Period, and ARR, numerical problems.

UNIT–V

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

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

TEXT BOOKS:

1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd, 2018.
2. Mart and Telsang, Industrial Engineering and Production Management, S.Chand & Company Ltd. NewDelhi, 2006.

REFERENCE BOOKS:

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

ONLINE LEARNING SOURCES

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

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: **R23ME2202**	**COMPLEX VARIABLES, PROBABILITY AND STATISTICS**						

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic.

CO2: Make use of the Cauchy residue theorem to evaluate certain integrals.

CO3: Infer the statistical inferential methods based on small and large sampling tests. **CO4: Solve** the differentiation and integration of complex functions used in engineering problems.

CO5: Design the components of a classical hypothesis test.

UNIT– I:

Functions of a complex variable and Complex integration:

Introduction, Continuity ,Differentiability, Analyticity, Cauchy-Riemann equations in Cartesian and polar coordinates, Harmonic and conjugate harmonic functions, Milne– Thompson method. Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, generalized integral formula (all without proofs) and problems on above theorems.

UNIT – II:

Series expansions and Residue Theorem:

Radius of convergence, Expansion of function in Taylor's series, Maclaurin's series and Laurent series. Types of Singularities: Isolated, Essential singularities, Pole of order m, Residues, Residue theorem (without proof), Evaluation of real integral of the types

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

UNIT – III:

Probability and Distributions:

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

UNIT – IV:

Sampling Theory:

Introduction, Population and Samples, Sampling distribution of Means and Variance (definition only), Point and Interval estimations, Maximum error of estimate, Central limit theorem (without proof), Estimation using t- test.

UNIT – V:

Tests of Hypothesis:

Introduction of Hypothesis, Null and Alternative Hypothesis, Type I and Type II errors, Level of significance, one tail and two-tail tests.

Test of significance for large samples and Small Samples: Single and difference means, Single and two proportions, Student's t- test, F-test, χ^2-test.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: **R23ME2203**	**MANUFACTURING PROCESSES**						

COURSE OBJECTIVE: The objectives of the course are to

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Design the patterns and core boxes for metal casting processes
CO2: Inspect the different welding processes
CO3: Analyze the different types of bulk forming processes
CO4: Analyze sheet metal forming processes
CO5: Distinguish about the different types of additive manufacturing processes

UNIT– I

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

HIGH ENERGY RATE FORMING PROCESSES: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

UNIT -V

ADDITIVE MANUFACTURING: 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.
Basics of Coatings and Semiconductor manufacturing Processes.

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.

ONLINE LEARNING 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

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: **R23ME2204**	**FLUID MECHANICS & HYDRAULIC MACHINES**						

COURSE OBJECTIVES: The students completing this course are expected to

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: **Analyze** the basic concepts of fluid properties and Calculation of metacenter height. Stability analysis and applications

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

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

CO4: **Estimate** the hydro dynamic forces of jet on vanes indifferent positions.

CO5: **Evaluate** the performance of hydraulic pumps and turbines.

UNIT-I

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 metacenter height. Stability analysis and applications.

UNIT-II

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 ir rotational 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: Reynolds's experiment- Darcy Weisbach equation- Minor losses in pipes- pipes in series and pipes in parallel total energy line hydraulic gradient line.

UNIT-III

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: 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.

UNITV

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. Advantages, limitations and applications.

CENTRIFUGAL PUMPS: classification, working, work done – manometric head- losses and efficiencies-specific speed-performance characteristic curves, cavitation & NPSH.

RECIPROCATING PUMPS: Working, Discharge, slip, indicator diagrams.

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 Turbo machinery, 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.
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. Rama Durgaiah, Fluid Mechanics and 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

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	30	70	100	3
Code: **R23ME2205**	**THEORY OF MACHINES**						

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:

After successful completion of this course, the students will be able to:

CO1: **Analyze** different mechanisms and inversions of four bar chain and slider crank chains.
CO2: **Evaluate** displacement, velocity and acceleration of different links in a mechanism.
CO3: **Apply** effects of gyroscopic couple in ships, aero planes and road vehicles and **Evaluate** the unbalanced mass in rotating machines using analytical and graphical methods.
CO4: **Design** different types of Cam and Gear Profiles.
CO5: **Analyze** free and forced vibrations of single degree freedom systems.

UNIT – I:

SIMPLE MECHANISMS: Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, Grubler's Criteria, 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.

UNIT – II:

PLANE AND MOTION ANALYSIS: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis – kinematic analysis of simple mechanisms – slider crank mechanism dynamics.

UNIT – III:

GYROSCOPE: Principle of gyroscope, gyroscopic effect in an aero plane, ship, car and two wheeler, simple problems.

BALANCING OF ROTATING MASSES: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

UNIT – IV:

CAMS: Classification of cams and followers- Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – derivatives of follower motions- specified contour cams- circular and tangent cams –pressure angle and undercutting.

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 – V:

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 without damping in single degree of freedom; Vibration isolation and transmissibility.

TURNING MOMENT DIAGRAMS: 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.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. F. Haidery, Dynamics of Machines, 5/e, NiraliPrakashan, Pune, 2003.
2. J.E. Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K. Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms 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.

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	30	70	100	1.5
Code: **R23ME22L1**	**FLUID MECHANICS & HYDRAULIC MACHINES LAB**						

COURSE OBJECTIVE:

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

- **CO1:** **Measure** the Impact of jets on Vanes
- **CO2:** **Evaluate** the operating parameters of turbines.
- **CO3:** **Evaluate** the operating parameters of pumps.
- **CO4:** **Determine** the friction factor and major losses in pipes.
- **CO5:** **Measure** the flow rate in Venturimeter, Orificemeter and Turbine Flow Meter

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-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).

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	30	70	100	1.5
Code: **R23ME22L2**	**MANUFACTURING PROCESSES LAB**						

COURSE OBJECTIVE:

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Make moulds for sand casting.

CO2: Make different types of components using various manufacturing techniques.

CO3: Analyze unconventional manufacturing methods.

CO4: Develop Different Weld joints.

CO5: Analyze different types of 3D Printing techniques.

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 Moulding
7. Blow Moulding
8. Simple models using sheet metal operations
9. Study of deep drawing and extrusion operations
10. To make weldments using TIG/MIG welding
11. To weld using Spot welding machine
12. To join using Brazing and Soldering
13. To make simple parts on a 3D printing machine
14. Demonstration of metal casting.

VIRTUAL LAB:

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

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	1	2	30	70	100	2
Code: **R23ME22L4**	**SOFT SKILLS**						

COURSE OBJECTIVES:

- To prepare for global competition in employment and achieve professional excellence.
- To help students develop interpersonal and intrapersonal skills, enabling them to lead meaningful professional lives.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Grasp the meaning and importance of soft skills and learn how to develop them.

CO2: Comprehend the significance of soft skills in the working environment for professional excellence.

CO3: Prepare to undergo the placement process with confidence and clarity.

CO4: Interpret any situation in life and equip themselves to handle them effectively.

CO5: Interpret the importance of etiquette in both professional and personal life.

UNIT – 1:

INTRODUCTION

Introduction- Emergence of life skills, Definition & Meaning, Importance& need, reasons for skill gap, Analysis--Soft Skills vs Hard skills, Linkage between industry and soft skills, Challenges, Personality Developments. Soft Skills, English - Improving Techniques.

UNIT – II:

INTRA-PERSONAL:

Definition-Meaning – Importance-SWOT analysis, Johari windows - Goal Setting- skills quotient - Emotional Intelligence- Attitudinal skills - positive thinking- Problem Solving-Time management, stress management.

UNIT – III:

INTER-PERSONAL:

Definition – Meaning – Importance-Communications skills- Team Work, managerial skills -Negotiation skills- Leadership skills, corporate etiquettes.

UNIT – IV:

VERBAL SKILLS:

Definition and Meaning-Listening skills, need- types, advantages, Importance- Tips for Improving Listening, Speaking, need- types, advantages, Importance- Tips for Improving Reading- Writing Skills, Report, Resume, statement of purpose, need- types, advantages, Importance.

UNIT – V:

NON VERBAL SKILLS& INTERVIEW SKILLS

Definition and Meaning – Importance- Facial Expressions- Eye Contact – Proxemics- Haptics - Posture, body language in cross cultural context , body language in interview room, appearance and dress code – Kinetics- Para Language - tone, pitch, pause, neutralization of accent, use of appropriate language, Interview skills, interview methods and questions.

TEXT BOOKS:

1. Sherfield, M. Robert at al, Cornerstone Developing Soft Skills, 4/e, Pearson Publication, New Delhi, 2014.
2. Alka Wadkar, Life Skills for Success, 1/e, Sage Publications India Private Limited, 2016.

REFERENCE BOOKS:

1. Sambaiah.M. Technical English, Wiley publishers India. New Delhi. 2014.
2. Gangadhar Joshi, From Campus to Corporate, SAGE TEXT.
3. Alex.K, Soft Skills, 3rd ed. S. Chand Publication, New Delhi, 2014.
4. Meenakshi Raman and Sangita Sharma, Technical Communication: Principle and Practice, Oxford University Press, 2009.
5. Shalini Varma, Body Language for Your Success Mantra, 4/e, S. Chand Publication, New Delhi, 2014.
6. Stephen Covey, Seven Habits of Highly Effective People, JMD Book, 2013.

ONLINE LEARNING RESOURCES:

- https://onlinecourses.nptel.ac.in/noc20_hs60/preview
- http://www.youtube.com/@softskillsdevelopment6210
- https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q&si=Fs05Xh8ZrOPsR8F4
- https://www.coursera.org/learn/people-soft-skills-assessment?language=English
- https://www.edx.org/learn/soft-skills

II B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	1	2	30	70	100	2
Code: **R23CC22L3**	**DESIGN THINKING & INNOVATION**						

COURSE OBJECTIVES:

The objectives of the course are to

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

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Explain the concepts related to design thinking.

CO2: Explain the fundamentals of Design Thinking and innovation.

CO3: Apply the design thinking techniques for solving problems in various sectors.

CO4: Analyse to work in a multidisciplinary environment.

CO5: Evaluate the value of creativity.

UNIT – I

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

UNIT - II

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

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

UNIT - III

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

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

UNIT - IV

PRODUCT DESIGN: Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V

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

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

TEXTBOOKS:

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

REFERENCE BOOKS:

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

ONLINE LEARNING RESOURCES:

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