SHRI VISHNU ENGINEERING COLLEGE FOR WOMEN (AUTONOMOUS)
BHIMAVARAM - 534202
Department of Mechanical Engineering
Course Structure – R23
(With effect from 2023-2024)

II Year - I Semester

S.No	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	BS	UGBS3T0423	Numerical Methods and Transform Techniques	3	0	0	3	30	70	100
2	HSMC	UGBS3T0623	Universal Human Values–Understanding Harmony & Ethical Human Conduct	2	1	0	3	30	70	100
3	ES	UGME3T0123	Thermodynamics	2	0	0	2	30	70	100
4	PC	UGME3T0223	Mechanics of Solids	3	0	0	3	30	70	100
5	PC	UGME3T0323	Material Science and Metallurgy	3	0	0	3	30	70	100
6	PC	UGME3P0423	Mechanics of Solids and Materials Science Lab	0	0	3	1.5	30	70	100
7	PC	UGME3P0523	Computer-aided Machine Drawing	0	0	3	1.5	30	70	100
8	ES	UGCS3P0723	Python programming Lab	0	0	2	1	30	70	100
9	SOC	UGEC3K0723	Embedded Systems and IoT	0	1	2	2	30	70	100
10	AC	UGBS3A0723	Environmental Science	2	0	0	-	-	-	-
			Total	**15**	**2**	**10**	**20**	**270**	**630**	**900**

II Year - II Semester

S.No	Category	Course Code	Course Title	L	T	P	C	IM	EM	TM
1	MC-I	UGMB4T0223	Industrial Management	2	0	0	2	30	70	100
2	BS	UGBS4T0423	Complex Variables, Probability and Statistics	3	0	0	3	30	70	100
3	PC	UGME4T0123	Manufacturing processes	3	0	0	3	30	70	100
4	PC	UGME4T0223	Fluid Mechanics & Hydraulic Machines	3	0	0	3	30	70	100
5	PC	UGME4T0323	Theory of Machines	3	0	0	3	30	70	100
6	PC	UGME4P0423	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5	30	70	100
7	PC	UGME4P0523	Manufacturing processes Lab	0	0	3	1.5	30	70	100
8	SOC	UGMB4K0323	Soft Skills	0	1	2	2	30	70	100
9	ES	UGME4P0623	Design Thinking & Innovation	1	0	2	2	100	-	100
			Total	**15**	**1**	**10**	**21**	**340**	**560**	**900**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation										

NUMERICAL METHODS AND TRANSFORM TECHNIQUES

Subject Code : UGBS3T0423	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Course Objectives:

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

Course Outcomes:

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

CO1: Classify and make use of approximate numerical methods to find roots of polynomial, transcendental equations and interpolate with equal and unequal intervals.(L2)

CO2: Apply numerical techniques to different Engineering problems and appropriate algorithms to solve ordinary differential equations with initial conditions. (L3)

CO3: Utilize the Laplace transform for solving differential equations(L3)

CO4: Demonstrate the Fourier series expansions of periodic function(L2)

CO5: Apply Fourier transforms to solve real time problems. (L4)

SYLLABUS:

UNIT – I: Iterative Methods: 10 Hrs.

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

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

UNIT – II: Numerical integration, Solution of ordinary differential equations with initial conditions: 9 Hrs.

Trapezoidal rule– Simpson's $1/3^{rd}$ and $3/8^{th}$ 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: 10 Hrs.

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

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

UNIT – IV: Fourier series: **9 Hrs**.

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: **10 Hrs**.

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

Mapping of COs to POs:

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	3	3	3	-	-	-	-	-	-	-	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3

Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. B. V. Ramana, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.
3. John Bird, Higher Engineering Mathematics, 6th Edition

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.

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Subject Code: UGBS3T0623	**L**	**T**	**P**	**C**
II Year / I Semester	**2**	**1**	**0**	**3**

Prerequisites: Basic Knowledge on Human Values

Course Objectives:

1) To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2) 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.
3) 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:

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

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

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

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

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

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

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

Syllabus:

UNIT I: Introduction to Value Education (**6L – 3T)**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.

Practice Sessions: PS1 - Sharing about Oneself; PS2 - Exploring Human Consciousness; PS3 - Exploring Natural Acceptance.

UNIT II: Harmony in the Human Being (6L – 3T)

Understanding Human being as the Co-existence of the self and the body, Distinguishing between the needs of the self and the body, The body as an Instrument of the self, Understanding Harmony in the self, Harmony of the self with the body, Programme to ensure self-regulation and Health.

Practice Sessions: PS4 - Exploring the difference of needs of self and body; PS5 - Exploring Sources of Imagination in the Self; PS6 - Exploring Harmony of self with the body.

UNIT III: Harmony in the Family and Society (6L – 3T)

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

Practice Sessions: PS7 - Exploring the Feeling of Trust; PS8 - Exploring the Feeling of Respect; PS9 - Exploring Systems to fulfil Human Goal.

UNIT IV: Harmony in the Nature/Existence (4L – 2T)

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

Practice Sessions: PS10 - Exploring the Four Orders of Nature; PS11 - Exploring Co-existence in Existence.

UNIT V: Implications of the Holistic Understanding – A Look at Professional Ethics (6L – 3T)

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

Practice Sessions: PS12 - Exploring Ethical Human Conduct, PS13 - Exploring Humanistic Models in Education, PS14 - Exploring Steps of Transition towards Universal Human Order.

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO2	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO3	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO4	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO5	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO6	-	-	-	-	-	3	3	3	-	-	-	3	-	-

Text Books:

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

Reference Books:

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

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

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

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

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

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life.

Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department. Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

THERMODYNAMICS

Subject Code: UGME3T0123	**L**	**T**	**P**	**C**
II Year / I Semester	**2**	**0**	**0**	**2**

Prerequisites: Familiarity with concepts of Engineering Physics, integration & differentiation.

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:

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

CO1: Apply the basic concepts of thermodynamics of a system with heat & work interactions.

CO2: Apply the Zeroth, first law of thermodynamics and steady flow energy equation to the various mechanical systems.

CO3: Assess the quality and quantity of energy and degree of disorderness.

CO4: Analyze the Mollier charts, T-S and h-s diagrams, Steam calorimetry, Phase Transformations

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

Syllabus:

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. 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 - 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,Vapour 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.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	3	3	-	-	-	-	-	-	2	3	-	-
CO3	3	3	-	-	-	-	-	-	-	-	2	2	-	-
CO4	3	3	-	-	-	-	-	-	-	-	2	2	-	-
CO5	3	3	3	2	-	-	-	-	-	-	2	2	-	-

Text Books:

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

Reference Books

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_3rd-Semester_Winter_2021_Mechanical-Engg.-_Thermal-Engineering-1_Abhijit-Samant.pdf
https://www.coursera.org/learn/thermodynamics-intro

MECHANICS OF SOLIDS

Subject Code: UGME3T0223	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with the concepts of Engineering Physics & Mechanics.

Course Objectives:

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

Course Outcomes:

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

CO1: Calculate the normal, shear and thermal stress for statically determinate and indeterminate structures and also draw Mohr's circle based on principle stresses.

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

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

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

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

CO6: Evaluate the torsion of circular bars and stability of column under different load conditions.

Syllabus:

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 – Relation between S.F., B.M and rate of loading at a section of abeam.

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. Wire wound thin cylinders. Lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

COLUMNS:

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

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	-	3	-	-	-	-	-	-	-	2	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	2	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	2	-	-
CO5	3	3	-	3	-	-	-	-	-	-	-	2	-	-
CO6	3	3	-	3	-	-	-	-	-	-	-	2	-	-

Text Books:

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

Reference Books:

1. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.
2.U.C.Jindal, Strength of Materials, 2/e, Pearson Education, 2017.
3.Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
4.Andrew Pytel and Ferdinand L. Singer, Strength of Materials,4/e, Longman Pulications, 1990.
5.Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

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/

MATERIAL SCIENCE & METALLURGY

Subject Code: UGME3T0323	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with basic engineering physics and mechanical properties.

Course Objectives:

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

Course Outcomes:

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

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

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

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

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

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

Syllabus:

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, 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 Castiron,greycastiron,Spheriodalgraphitecastiron,Alloycastiron. Classificationofsteels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

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

UNIT–III

Heat treatment of Steels: Effect of alloying elements on Fe-Fe_3C system, annealing, normalizing, hardening, TTT diagrams, tempering, harden ability, 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.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	2	-	-	-	-	-	-	-	3	2	3
CO2	3	2	3	2	-	-	-	-	-	-	-	3	3	2
CO3	3	3	2	3	-	-	-	-	-	-	-	3	2	3
CO4	3	2	3	3	-	-	-	-	-	-	-	3	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3

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.

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.

MECHANICS OF SOLIDS & MATERIALS SCIENCE LAB

Subject Code: UGME3P0423	**L**	**T**	**P**	**C**
II Year / I Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Basic knowledge of engineering chemistry, basics of physics and mechanical properties of materials.

Course Objectives:

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

Course Outcomes:

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

CO1: Understand the stress strain behavior of different materials.

CO2: Evaluate the hardness of different materials.

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

CO4: Identify various microstructures of steels and cast irons.

CO5: Evaluate hardness of treated and untreated steels.

Syllabus:

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

A.MECHANICS OF SOLIDS LAB:

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

B.MATERIAL SCIENCE LAB:

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

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	3	2	-	-	-	-	-	-	-	3	2	3
CO2	3	3	3	2	-	-	-	-	-	-	-	3	2	3
CO3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	2	2	3
CO5	3	3	2	2	-	-	-	-	-	-	-	3	3	2

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).

COMPUTER-AIDED MACHINE DRAWING

Subject Code: UGME3T0523	**L**	**T**	**P**	**C**
II Year / I Semester	**0**	**0**	**3**	**1.5**

Prerequisites: The basic knowledge of Engineering Drawing includes Conventional and Orthographic views.

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 inmating components

Course Outcomes:

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

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

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

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

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

CO5: Translate 3D assemblies into 2D drawings.

Syllabus:

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

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

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

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

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

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

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

Creating solid models of complex machine parts and sectional views.

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

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

Production drawing:

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

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	-	-	-	3	-	-	-	-	-	-	3	-	3
CO2	2	-	3	-	3	-	-	-	-	-	-	3	3	-
CO3	2	-	3	-	3	-	-	-	-	-	-	3	3	-
CO4	2	-	3	-	3	-	-	-	-	-	-	3	2	-
CO5	2	-	3	-	3	-	-	-	-	-	-	3	2	-

Textbooks:

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

PYTHON PROGRAMMING LAB

Subject Code: UGCS3P0723	**L**	**T**	**P**	**C**
II Year / I Semester	**0**	**0**	**2**	**1**

Prerequisites: Basic understanding of Computer Programming terminologies.

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:

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

CO1: Set up Python and write basic programs using correct syntax.

CO2: Apply core programming concepts like variables, control structures, and functions.

CO3: Develop programs using lists, tuples, dictionaries, and sets.

CO4: Implement file handling and error management in Python.

CO5: Utilize Python libraries for data manipulation and API interaction**.**

Syllabus:

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.

Mapping of COs to POs

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	3	2	2	2	2	-	-	-	-	-	-	2
CO2	3	3	2	2	2	-	-	-	-	-	-	2
CO3	3	3	3	2	2	-	2	-	2	2	-	2
CO4	3	2	2	2	2	-	2	-	2	2	-	2
CO5	3	2	3	2	3	2	2	2	3	2	2	3

REFERENCES:

1. https://www.udemy.com/course/python-the-complete-python-developer-course/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaig n=BG-Python_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=_._ag_1220458320107116_._ad._kw_Python+language_._de_c_._dm._pl._ti_kwd-76278984197882%3Aloc-90_._li_116074_._pd._&couponCode=IND21PM

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

EMBEDDED SYSTEMS & IoT

Subject Code: UGEC3K0723	**L**	**T**	**P**	**C**
II Year/ I Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Basic Electronics.

Course Objectives:

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

Course Outcomes:

Upon 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. Understand the concept of M2M (machine to machine) with necessaryprotocols and get awareness in implementation of distance sensor.

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

Syllabus:

List of Experiments

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 HyperTerminal.
4. Drive a given string on HyperTerminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on HyperTerminal.

Internet of Things Experiments

(Any 5experiments from the following)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for theRaspberry Pi and how to trace and debug Python b code on the device.
3. Using Raspberry pi

a. Calculate the distance using distance sensor.

b. Basic LED functionality.

4. Raspberry Pi interacts with online services using public APIsand 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.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3		3										3	
CO2	3		3										3	
CO3	3		3										3	
CO4	3		3										3	
CO5	3		3										3	

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

ENVIRONMENTAL SCIENCE
(AUDIT COURSE)

Subject Code: UGBS3A0723	**L**	**T**	**P**	**C**
II Year / I Semester	**2**	**0**	**0**	**0**

Course Objectives:

- To make the students aware of the 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 the earth from the inventions of engineers.

Course Outcomes:

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

CO1: Grasp the multi-disciplinary nature of environmental studies and various renewable and non-renewable resources.
CO2: Understand flow and bio-geo-chemical cycles and ecological pyramids.
CO3: Understand various causes of pollution and solid waste management and related preventive measures.
CO4: Understand rainwater harvesting, watershed management, ozone layer depletion, and wasteland reclamation.
CO5: Illustrate the causes of population explosion, value education, and welfare programs.

Syllabus:

UNIT I: (9 Hours)

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 groundwater – 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: (8 Hours)

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: (12 Hours)

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: (8 Hours)

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: (8 Hours)

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.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	3	-	-	-	-	-	-	-
CO3	-	-	3	-	3	3	3	-	-	-	-	2	-	-
CO4	-	-	-	-	2	3	3	-	-	-	-	2	-	-
CO5	-	-	-	-	-	3	3	-	-	-	-	2	-	-

TEXT BOOKS:

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

REFERENCE BOOKS:

1. 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.

INDUSTRIAL MANAGEMENT

Subject Code: UGMB4T0223	**L**	**T**	**P**	**C**
II Year / II Semester	**2**	**0**	**0**	**2**

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:

COs	Description	Bloom's Level
CO1	Learn about how to design the optimal layout	**I – Remember**
CO2	Demonstrate work study methods	**II - Understanding**
CO3	Explain Quality Control techniques	**I – Remember**
CO4	Discuss the financial management aspects and	**II - Understanding**
CO5	Understand the human resource management methods.	**II - Understanding**

Syllabus:

UNIT– I

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, the 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, and 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 the optimal design of layouts, plant maintenance, preventive and breakdown 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.

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

UNIT– IV

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

UNIT–V

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

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

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	-	-	-	-	-	-	-	-	-	-	-	1
CO3	-	-	-	-	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	-	-	2	3	2
CO5	-	-	-	-	-	-	-	-	2	3	3	2

Text Books:

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

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

Reference Books:

1. Bhattacharya DK, Industrial Management, S.Chand, publishers, 2010.

2. J.G Monks, Operations Management,3/e, McGraw Hill Publishers1987.

3. T.R. Banga, S.C.Sharma, N. K. Agarwal, Industrial Engineering and Management Science, Khanna Publishers, 2008.

4. 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.

COMPLEX VARIABLES, PROBABILITY AND STATISTICS

Subject Code :UGBS4T0423	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Course Objectives:

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

Course Outcomes:

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

CO1: Demonstrate Cauchy-Riemann equations to complex functions in order to examine whether a given continuous function is analytic.(L2)

CO2: Utilize the Cauchy residue theorem and series expansion to evaluate certain integrals. (L3)

CO3: Make use of Baye's theorem and theoretical (discrete & continuous) probability distributions to solve real world problems. (L3)

CO4: Apply sampling distribution and estimate the population parameters and maximum error of estimate.(L3)

CO5: Infer the statistical inferential methods based on small and large sampling tests.(L4)

SYLLABUS:

UNIT– I: Functions of a complex variable and Complex integration: **12 Hrs.**

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: **10 Hrs.**

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

Types of Singularities: Isolated – Essential –Pole of order m– Residues –

Residue theorem (without proof) – Evaluation of real integral of the types $\int_c^{c+2\pi} f(x)dx$

and $\int_c f(\cos\theta, \sin\theta)d\theta$

UNIT–III: Probability and Distributions: **12 Hrs.**

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: 7 Hrs.

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only)–Central limit theorem (without proof)–Representation of the normal theory distributions– Introduction to t, χ^2 and F-distributions- point and interval estimations – maximum error of estimate.

UNIT–V: Tests of Hypothesis: 7 Hrs.

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

Mapping of COs to POs:

POs	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	-	-	-	-	-	-	-	-	-	3
CO2	3	3	-	-	-	-	-	-	-	-	-	3
CO3	3	3	-	3	-	-	-	-	-	-	-	3
CO4	3	3	-	3	-	-	-	-	-	-	-	3
CO5	3	3	-	3	-	-	-	-	-	-	-	3

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers.
2. T.S.R.Murthy, Probability and Statistics, I.K. International Publishing House Pvt. Ltd.
3. Miller and Freund's, Probability and Statistics for Engineers,7/e,Pearson,2008.

Reference Books:

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

MANUFACTURING PROCESSES

Subject Code: UGME4T0123	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with concepts of Engineering Physics and Material science.

Course Objectives: 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:

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

CO1: Apply the terminology of metal casting processes and differentiate casting processes.

CO2: Make use of different welding processes for different materials.

CO3: Cateorize the bulk forming and sheet metal forming operation.

CO4: Outline the blue print of Additive Manufacturing for Product Development.

CO5: Integrate of Manufacturing Principles and Practices.

Syllabus:

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

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	2	2	-	-	-	-	-	3	-	2	3	3
CO2	3	3	2	2	-	-	-	-	-	3	-	2	3	3
CO3	3	3	2	2	-	-	-	-	-	3	-	2	3	3
CO4	3	3	2	2	-	-	-	-	-	3	-	2	3	3
CO5	3	3	2	2	-	-	-	-	-	3	-	2	3	3

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

FLUID MECHANICS & HYDRAULIC MACHINES

Subject Code: UGME4T0223	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basic knowledge of Engineering Physics and Engineering Mechanics.

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:

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

CO1: Explain the effect of fluid properties on a flow system.

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

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

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

CO5: Analyze the performance of hydraulic pumps and turbines.

Syllabus:

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 irrotational flow, flownet, source and sink, double tand 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 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, Peltonwheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design –draft tube-theory-functions and efficiency.

UNIT V:

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.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	2	2	-	-	-	-	-	-	2	2	-
CO5	3	3	2	2	2	-	-	-	-	-	-	3	2	2

Text Books:

1.Y.A.Cengel,J.M.Cimbala,FluidMechanics,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

THEORY OF MACHINES

Subject Code: UGME4T0323	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Familiarity with concepts of Engineering Physics & Mechanics.

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:

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

CO1: Understand different mechanisms and their inversions.

CO2: Calculate velocity and acceleration of different links in a mechanism.

CO3: Apply the effects of gyroscopic couple in ships, aero planes and road vehicles.

CO4: Evaluate unbalance mass in rotating machines.

CO5: Analyze free and forced vibrations of single degree freedom systems.

Syllabus:

UNIT – I: Simple Mechanisms 10 Hrs

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

UNIT – II: Plane and motion analysis 12 Hrs

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

UNIT – III: Gyroscope & Gear Profile 10Hrs

Gyroscope: Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two wheeler, simple problems

Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

UNIT – IV: Balancing of Rotating masses & Cams 12 Hrs

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

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

UNIT – V: Vibrations & Turning Moment Diagrams and Flywheels 10Hrs

Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations- under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.

Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	2	3	2	3	-	-	-	-	-	-	-	-	2	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	3	-

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.

FLUID MECHANICS & HYDRAULIC MACHINES LAB

Subject Code: UGME4P0423 **L T P C**

II Year / II Semester **0 0 3 1.5**

Prerequisites: Knowledge of Fluid Mechanics & Hydraulic Machines.

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

Course Outcomes:

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

CO1: Test the behavior of fluids in static and dynamic conditions.

CO2: Compute major and minor losses in pipes.

CO3: Determine the hydrodynamic forces acting on vanes.

CO4: Evaluate the performance of Turbines under different working conditions.

CO5: Evaluate the performance of pumps under different working conditions.

Syllabus:

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.

NOTE: Any 10 experiments from above.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	-	-	3	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	3	-	-	-	-	-	-	-	3	-	-

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).

MANUFACTURING PROCESSES LAB

Subject Code: UGME4P0523	**L**	**T**	**P**	**C**
II Year / II Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Familiarity with concepts of Engineering Physics and Material science.

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

Course Outcomes:

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

CO1: Make moulds for sand casting.

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

CO3: Adapt unconventional manufacturing methods.

CO4: Develop Different Weld joints.

CO5: Explain different types of 3d Printing techniques.

Syllabus:

List of Experiments

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

11.To weld using Spot welding machine
12.To join using Brazing and Soldering
13.To make simple parts on a 3D printing machine
14.Demonstration of metal casting.

NOTE: Any 10 experiments from above.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	3	3	-	-	-	-	-	3	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	3	-	3	3	3
CO3	3	3	3	3	-	-	-	-	-	3	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	3	-	3	3	3
CO5	3	3	3	3	-	-	-	-	-	3	-	3	3	3

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

SOFT SKILLS

Subject Code: UGMB4K0323	**L**	**T**	**P**	**C**
II Year / II Semester	**0**	**1**	**2**	**2**

Course Objectives:

- To prepare to face global competition for employment and excellence in profession.
- To help the students understand and build interpersonal and interpersonal skills that will enable them to lead meaningful professional life.

Course Outcomes:

COs	**Description**	**Bloom's Level**
CO1	Assimilate and understood the meaning and importance of soft skills and learn how to develop them.	**I – Remember**
CO2	Understand the significance of soft skills in the working environment for professional excellence.	**II - Understanding**
CO3	Prepare to undergo the placement process with confidence and clarity.	**I – Remember**
CO4	Ready to face any situation in life and equip themselves to handle them effectively.	**II - Understanding**
CO5	Understand and learn the importance of etiquette in both professional and personal life.	**II - Understanding**

Syllabus:

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, Soft Skills vs English – Improving Techniques.

UNIT – II: Intra-Personal:

Definition-Meaning – Importance-SWOT analysis, Johari windows - Goal Setting-quotient skills - Emotional Intelligence- Attitudinal skills - Right 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-Improving Tips for Listening, Speaking, need- types, advantages, Importance-Improving Tips, Reading- Writing Skills, Report, Resume, statement of purpose, need- types, advantages, Importance-Improving Tips.

UNIT – V: Non-Verbal Skills & Interview skills

Definition and Meaning – Importance- Facial Expressions- Eye Contact – Proxemics- Haptics -Posture, cross cultural body language, 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.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	2
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	2
CO5	-	-	-	-	-	-	-	-	-	3	-	2

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.

DESIGN THINKING & INNOVATION

Subject Code: UGME4P0623	**L**	**T**	**P**	**C**
II Year / II Semester	**1**	**0**	**2**	**2**

Prerequisites: -

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:

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

CO1: Define 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.

Syllabus:

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.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	-	3	3	-	-	3	-	-	-	-	-	-	-	-
CO2	-	3	3	-	3	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	3	2	3	3	3	3	-	-
CO4	-	-	-	-	-	3	3	2	3	3	3	3	-	-
CO5	-	-	3	3	-	3	3	3	3	3	3	3	-	-

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

Evaluation Guidelines:

- "Design Thinking & Innovation" course is conducted as a practical course.
- The course is evaluated for 100 marks out of which 50 marks are allotted for day-to-day work. Another 50 marks are allotted for the internal evaluation at the end of semester.

i) Day-to-day work:

- Student groups shall be formed, and assessments will be conducted after the completion of each unit. Each unit assessment will carry a weightage of 10 marks, culminating in a total of 50 marks over the course of 5 units.

Assessment methods shall include:

i. Power point presentations
ii. Charts
iii. Posters
iv. Prototypes

ii) Internal Evaluation:

- At the end of semester, students should present their idea and rubric for 50 marks is listed below.

1. Understanding the problem : 10 marks
2. Idea generation & creativity : 10 marks
3. Prototype & Model making : 10 marks
4. Presentation skills : 10 marks
5. Practical application : 10 marks