GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
NEP 2020–Scheme of Teaching & Examination
W.E.F. Session: 2024-2025
B. TECH SECOND YEAR, III SEMESTER

SN	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
1	IPUCTT4	Material Science and Metallurgy	3	–	–	40	60	100	3
2	IPUCTT5	Mechanics of Materials	3	–	–	40	60	100	3
3	IPUCTT6	Engineering Thermodynamics	3	–	–	40	60	100	3
4	IPUCTT7	Theory of Machines	3	–	–	40	60	100	3
5	IPUCTP_	*Professional Elective-1/2*	3	–	–	40	60	100	3
6	_UCTO_	*Open Elective*	3	–	–	40	60	100	3
Total			**18**	–	–	**240**	**360**	**600**	**18**
PRACTICALS									
1	IPUCLT2	Mechanics of Materials Lab	–	–	2	25	25	50	1
2	IPUCLT3	Theory of Machines Lab	–	–	2	25	25	50	1
Total			**–**	**–**	**4**	**50**	**50**	**100**	**2**
GRAND TOTAL			**18**	**-**	**4**	**290**	**410**	**700**	**20**

List of Department/ Professional Elective		
SN	Course No.	Subject
1.	IPUCTP1	Business Communication and Professional Skills
2.	IPUCTP2	Effective Technical Communication

Institute Core/ Open Elective offered by the Department			
SN	Course No.	Subject	Offering Department
1.	IPUCTO2	Introduction to Industrial Engineering	IPE

Internal Assessment: – Two class tests of 15 marks each will be conducted. Moreover, 5 marks will be for attendance and 5 marks are allocated for the Assignments, surprise test, quiz test etc.

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech III Sem	IPUCTT4	Material Science and Metallurgy	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. To provide knowledge of different material crystal structures, arrangement of atoms and mechanical properties.
2. To know different solid solutions and phase diagrams.
3. To draw TTT curves and Iron carbon diagrams.
4. To select various engineering materials based on composition and properties for a given application.
5. To introduced various material testing methods related to its mechanical and functional properties.

COURSE CONTENT:

Module-I

Crystal Structure: BCC, FCC and HCP Structures, coordination number and atomic packing factors, crystal imperfections –point, line and surface imperfections. Atomic Diffusion: Phenomenon, Flick's laws of diffusion, factors affecting diffusion.

Mechanical Behavior: Stress-strain diagram for ductile and brittle materials, True stress and true strain, linear and non linear elastic behavior and properties, mechanical properties in plastic range, yield strength, offset yield strength, ductility, ultimate tensile strength, and toughness. Plastic deformation of single crystal by slip and twinning.

Module-II

Solidification and Solid Solutions: Mechanism of solidification, Homogenous and Heterogeneous nucleation, crystal growth, cast metal structures, solid solutions- types and rules governing the formation of solid solutions.

Phase Diagram: Basic terms, phase rule, lever rule, cooling curves, construction and interpretation of different phase diagrams (eutectic, eutectoid, peritectic and peritectoid)

Module-III

Heat Treatment of Metals: TTT curves, continuous cooling curves, annealing and its types. normalizing, hardening, tempering, martempering, austempering, hardenability, surface hardening methods like carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of Aluminium-copper alloys.

Module-IV

Types and application of common engineering materials: Metals, Alloys, Semiconductors, Ceramics, Polymers and Composites (metal, polymer and ceramic based).

Ferrous Materials: Properties, Composition and uses of Grey cast iron, malleable iron, S.G iron and steel.

Non Ferrous Metals: Copper alloys-brasses and bronzes. Aluminum alloys-Al-Cu, Al-Si, Al-Zn alloys.

Module-V

Testing of Materials: Non-Destructive Testing, Tensile testing, compression testing - Hardness Testing. Impact testing, Fatigue testing, Creep, other related testing methods characterization of TEM, XRD, SEM.

TEXT & REFERENCE BOOKS:

1. Materials Science and Engineering: An Introduction – W. D. Callister.
2. Engineering Materials – Kenneth G. Budinski and Michael K. Budinski.
3. Material Science and Engineering – V. Raghavan.
4. Engineering Materials and Metallurgy – U. C. Jindal.
5. An introduction to Metallurgy– Alan Cottrell.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Explain different types of material crystal structures, arrangement of atoms and mechanical properties of materials.

CO2: Explain the concept of equilibrium diagram, cooling curves and phase diagrams for pure metals and alloys.

CO3: Understand the application of various heat treatment operations.

CO4: Identify the different types of materials, alloys and explain its properties.

CO5: Apply and explain various methods of material testing procedures.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	3	1	-	-	-	-	-	-	2	2	3	1
CO2	3	2	2	1	3	-	-	-	-	-	-	2	3	3	1
CO3	3	2	1	2	2	-	-	-	-	-	-	2	3	3	3
CO4	3	2	3	2	3	-	-	-	-	-	-	2	3	3	3
CO5	3	2	1	2	1							2	2	3	3

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech III Sem	IPUCTT5	Mechanics of Materials	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Use different material properties and characteristics for various mechanical and structural applications.
2. Categorize the stress and strain on the basis of different conditions/type of loading/nature of loading.
3. Determine the various parameters such as stress, strain and deflection for various specimens.
4. Compare the result using theoretical, graphical and experimental approach.
5. Draw stress strain curve to show mechanical properties of material.
6. Propose technique/methods to solve problems that match the one's strength.

COURSE CONTENT:

Module-I

Simple stresses and strains: Concept of stress and strain, St. Venant's principle, stress and strain diagram, elasticity and plasticity, types of stresses and strains, Hooke's law, stress–strain diagram for mild steel, working stress, factor of safety, lateral strain, Poisson's ratio, volumetric strain. Elastic moduli and relationship between them, bars of varying section, composite bars, and temperature stresses. Strain energy, resilience, gradual, sudden, impact and shock loadings, simple applications.

Module-II

Compound stresses and strains: Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two-dimensional stress–strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain.

Module-III

Bending moment and Shear force diagrams: Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Module-IV

Bending stress: Flexural stresses, theory of simple bending, assumptions, derivation of bending equation: M/I = f/y = E/R, neutral axis, determination of bending stresses, section modulus of rectangular and circular sections (solid and hollow), I,T, angle and channel sections, design of simple beam sections.

Shear stresses: Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Slope and deflection: Relationship between moment, slope and deflection, moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

Module-V

Torsion: Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close coiled helical springs.

Thin cylinders and spheres: Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder and sphere subjected to internal pressures.

TEXT & REFERENCE BOOKS:

1. Elements of Strength of Materials–S.Timoshenko and D. H. Young, Affiliated East-West Press.
2. Solid Mechanics –S. M. A Kazmi,McGraw-Hill.
3. Mechanics of Materials–R.C.Hibbeler, Pearson.
4. An Introduction to the Mechanics of Solids–S. H. Crandall, N. C. Dahl and T. J. Lardner,Tata McGraw Hill,Education Private Limited (2012).
5. Laboratory Manual of Testing Materials – William Kendrick Hall, Prentice Hall of India.
6. Mechanics of Materials – Ferdinand P. Beer, E. RusselJhonston Jr., John T. D E Wolf, McGraw Hill.
7. Strength of Materials– R. Subramanian, Oxford University Press.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1. Propose material properties for different mechanical and structural applications.
CO2. Formulate the fundamental concepts of stress/strain.
CO3. Examine various techniques to solve structural/mechanical members subjected to combined loading.
CO4. Apply various failure criteria for general stress states at points.
CO5. Use method of solution that matches one's capability.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	2	3	1	3
CO2	3	3	2	2	2	-	-	-	-	-	-	2	3	1	3
CO3	3	2	2	3	2	-	-	-	-	-	-	2	3	1	3
CO4	3	2	2	3	2	-	-	-	-	-	-	2	3	1	3
CO5	3	3	2	2	2	-	-	-	-	-	-	2	3	1	3

Note: 1: Slight (Low); 2: Moderate (Medium); 3: Substantial (High);

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech III Sem	IPUCTT6	Engineering Thermodynamics	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. To provide a mature approach to the basic principle of classical thermodynamics and to apply it to system surroundings interactions; involving work and heat transfer with associated property changes.
2. To use classical thermodynamics principles to develop algebraic relationships among key physical parameters and variable based on analysis of a specified system.
3. Apply laws of thermodynamic while solving engineering problems.
4. Use references that provide tabulated physical data that are useful to solve real life engineering problems.
5. To provide a fundamental understanding of the principles of heat transfer due to conduction, convection and radiation.

COURSE CONTENT:

Module –I

Basic Concept: Microscopic & macroscopic point of view, Thermodynamic system and control volume, Thermodynamic properties, processes and cycles, equilibrium, Quasi-static process, reversible and irreversible process, concept of temperature, Zeroth law of thermodynamics, Heat and Work transfer, pure substance**.**

First law of thermodynamics: Concepts of internal energy, specific heat capacities, enthalpy, energy balance for closed and open systems, energy balance for steady and unsteady flow processes, and its applications.

Module –II

Second law of thermodynamics: Thermal energy reservoirs, Limitations of first law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence, Perpetual motion machine of the second kind, Carnot cycle, Heat Engine,reversed Carnot cycle, refrigerator and heat pump.

Entropy: Clausius theorem, Concept of entropy, Clausius inequality,entropy change in an open system, reversible and irreversible process, principle of increase of entropy, Third law of thermodynamics, Entropy and disorder, concept of exergy.

Module –III

Properties of pure substances: Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, p–V, p–T, T–v, T–s, h–S diagrams, pvT surfaces, thermodynamic properties of steam,

calculations of work done and heat transfer in non– flow and flow processes.

Module –IV

Vapour power cycles: Carnot cycle, Rankine cycle, Reheat cycle, Regenerative cycle, thermal efficiency and work ratios, factors affecting efficiency and work output.

Module –V

Heat Transfer: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, combined modes of heat transfer, thermal diffusivity, overall heat transfer coefficient. Basic concept of convection and its application, basic conceprts of Radiation: black and non-black bodies, geometric configuration factors.

TEXT & REFERENCE BOOKS:

1. Engineering Thermodynamics – P.K. Nag, Tata McGraw Hill Education.
2. Thermodynamics – An Engineering Approach – Cengel, McGraw Hill Education.
3. Fundamentals of thermodynamics – Sonntag & G. J. V. Wylen, John Wiley and Sons.
4. Fundamentals of Engineering Thermodynamics – M. J. Moran, H. N. Shapiro, D. D. Boettner& M. Bailey, JohnWiley & Sons.
5. Engineering thermodynamics – J. B. Jones & R. E. Dugan, Prentice Hall.
6. Outline of Thermodynamics for Engineers – M. C. Potter& C. W. Schaum's Somerton, McGraw-Hill Education.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1. Describe the basic concepts of thermodynamics such as conservation of mass and energy, work interaction, heat transfer, Zeroth and first law of thermodynamics.
CO2. Apply the second law of thermodynamics and concept of entropy for different thermodynamic systems.
CO3. Demonstrate the importance of phase change diagrams of various pure substances.
CO4. Analyze the performance of vapor power cycles and identify methods to improve thermodynamic performance.
CO5. Explain the basics of heat transfer and identify different modes of heat transfer.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	3	2	3	-	-	1	-	-	-	-	1	2	2	-
CO2	3	3	3	2	-	-	-	-	-	-	-	1	2	2	
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	1	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	2	2	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignments, surprise test, quiz test etc	Attendance	SEA		
B. Tech III Sem	IPUCTT7	Theory of Machines	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

The objective of this course is to:

1. Impart knowledge of various types of links, mechanisms and machines and kinematics inversions.
2. Solving practical problems related to design of linkage mechanisms and cam and follower systems to generate specified output motions.
3. Learn the importance of kinematics and fundamental principles behind belt, rope and chain drives.
4. To analyze gyro-effect on moving bodies.
5. To study the types of gears and to analyze various gear trains.
6. To study the types of mechanical governors and to analyze its performance parameters

COURSE CONTENT:

Module – I

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 generators, universal joint, rocker mechanisms.

Module –II

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, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers.

Module –III

Belt, Rope and Chain drive –types of belts and belt drives, V.R . and slip , creep, length power transmitted and ratio of tensions, centrifugal tension, maximum tension, initial tension, V –Belt drive and Rope drives and its ratio of tensions types of chain and chain drives.

Module –IV

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, compound, reverted and epicyclic gear trains, velocity ratio of epicyclic gear trains

Module – V

Gyroscope - velocity, acceleration and effect of Gyroscope couple on aeroplane , naval ship pitching and rolling , stability of two and four wheel drive in a turning .

Governors: Characteristics of centrifugal governors, Gravity controlled governors, Porter and Proell. Spring controlled centrifugal governor: Hartung and Hartnell governor, performance parameter: sensitivity, stability, isochronisms, governor effort and power.

TEXT & REFERENCE BOOKS:

1. Theory of Machines– Thomas Bevan,CBS Publishers.
2. Mechanisms of Machines– W.L. Cleghorn, Oxford University Press, 2015.
3. Kinematics and Dynamics of Machinery– L. Norton Robert, McGraw-Hill.
4. Theory of Mechanisms and Machines – A. Ghosh, A. K. Mallik – EWP Press.
5. Theory of Machines and Mechanisms - J.Uicker, Gordon R Penstock & J.E. Shigley – Oxford International Edition.
6. Theory of Machines- by R S Khurmi, S Chand & Co Ltd.
7. Theory of Machines- by Rattan S S, McGraw Hill Education India Private Limited.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Apply knowledge of Kinematics of machine for understanding, formulating and solving engineering problems.
CO2: Construct cam profiles and analysis of their velocity and acceleration.
CO3: Understand the basic concept of belt, rope and chain drive and their practical applications.
CO4: Understand the different types of gears, gear terminology, important gear trains and their practical applications.
CO5: Understand the various types of governors and its applications.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	2	3	1	3
CO2	3	2	2	3	2	-	-	-	-	-	-	2	3	1	3
CO3	3	2	2	3	2	-	-	-	-	-	-	2	3	1	3
CO4	3	2	2	3	2	-	-	-	-	-	-	2	3	1	3
CO5	3	3	2	2	2	-	-	-	-	-	-	2	3	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech III Sem	IPUCTP1	Business Communication and Professional Skills	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Understand necessary skills for technical communication and its role in a technical organization.
- Develop outer and inner personality traits to enrich the business capabilities and to meet the challenges associated with different job levels in a market.
- Rule out development in style, personality, presentation, speaking, reading and writing skills
- Estimate the psychological aspects of communication via gaining technical knowledge and to understand the importance of cultural factors in communication.
- Demonstrate body language, use of voice during presentation in relation to the audience during presentation.

COURSE CONTENT:

Module-I

Business communication: Role of communication in information age, concept and meaning of communication, skills necessary for technical communication, communications in a technical organization, barriers to the process of communication and sola.

Module–II

Style and organization in technical communication: Listening, speaking, reading and writing as skills, objectivity, clarity, precision as defining features of technical communication, various types of business writing: letters, reports, notes, memos, language and format of various types of business letters, language and style of reports, report writing strategies, analysis of a sample report.

Module-III

Communication and personality development: Psychological aspects of communication, cognition as a part of communication, emotional intelligence, politeness and etiquette in communication, cultural factors that influence communication, mannerisms to be avoided in communication, language and persuasion, language and conflict resolution.

Module-IV

Language laboratory: Emphasizing listening and comprehension skills, reading skills, sound structure of English and intonation patterns.

Module-V

Oral presentation and professional speaking: Basics of English pronunciation, elements of effective presentation, body language and use of voice during presentation, connecting with the audience during presentation, projecting a positive image while speaking, planning and preparing a model presentation, organizing the presentation to suit the audience and context, basics of public speaking, preparing for a speech.

TEXT & REFERENCE BOOKS:

8. Organizational Behaviour – Fred Luthans, McGraw Hill.
9. Report writing for Business – Lesikar and Petit.
10. Effective Technical Communication – M. Ashraf Rizvi, McGraw Hill.
11. Personal Development for Life and Work – Wallace and Masters, Thomson Learning.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1. Present himself under the different domain of markets.
CO2. Project a positive image of the associated organization, while speaking, planning and preparing a presentation.
CO3. Develop leadership style, listening & interacting skills to handle conflict situations based on personality and communication.
CO4. Adapt attitudinal changes, cultural speaking and technical communication.
CO5. Utilize decision–making qualities, emotional intelligence, politeness and etiquette in communication.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	1	-	-	-	-	1	1	2	-
CO2	3	1	1	-	-	-	-	-	1	-	-	1	2	2	2
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	-	2
CO4	3	2	1	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	1	2	2	-	-	-	-	-	-	-	-	2	2	1

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech III Sem	IPUCTP2	Effective Technical Communication	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

Effective Technical communication is critical in today's world. Most problems in an organization arise as a result of poor communication. Effective communication ensures a smooth flow of ideas, facts, decisions, and advice. This way, employees eliminate hindrances in achieving the organization's target.

COURSE CONTENT:

Module-I

Fundamentals of Communication Technical Communication: features: Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communications; the flow of Communication: Downward, Upward, Lateral of Horizontal (Peer group): Importance of technical communication; Barriers to Communication.

Module-II

Constituents of Technical Written Communication Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Correct Usage: all Parts of Speech; Modals; Concord; Articles; Infinitives; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods- Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation-various steps.

Module-III

Business Communication Principles, Sales & Credit letters; Claim and Adjustment Letters; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports. Technical Proposal; Parts; Types; Writing of Proposal; Significance. Negotiation & Business Presentation skills.

Module-IV

Presentation Strategies and Listening Skills. Defining Purpose; Audience & Local; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Listening Skills:Active Listening, Passive Listening. methods for improving Listening Skills.

Module-V

Value-Based Text Readings Following essays form the suggested text book with emphasis on Mechanics of writing. (i) Humanistic and Scientific Approaches to Human Activity by Moody E. Prior (ii) The Language of Literature and Science by A. Huxley (iii) Man and Nature by J.Bronowski (iv) The Social Function of Literature by Ian Watt (v) Science and Survival by Barry Commoner (vi) The Mother of the Sciences by A.J.Bahm (vii) The Effect of Scientific Temper on Man by BertrandRussell.

TEXT & REFERENCE BOOKS:

1. Improve Your Writing ed. V.N.Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi..
2. Technical Communication: A Practical Approach: Madhu Rani and Seema Verma- Acme Learning, NewDelhi2011
3. Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press,2007, New Delhi.
4. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt.Ltd,2011, New Delhi.
5. Business Correspondence and Report Writing by Prof. R.C.Sharma& Krishna Mohan, Tata McGraw Hill &Co.Ltd.,2001, New Delhi.
6. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. &Distributors, 2009, Delhi.
7. Developing Communication Skills by Krishna Mohan, Mecra Bannerji- Macmillan India Ltd. 1990, Delhi.
8. Manual of Practical Communication by L.U.B.Pandey: A.I.T.B.S. Publications India Ltd.; Krishan Nagar,2013, Delhi.
9. English Grammar and Usage by R.P.Sinha,

COURSE OUTCOMES:

CO1. At the end of the semester, employability skills of the students will develop.
CO2. Students will improve their Vocabulary and their Accent.
CO3. Enable students with the confidence to use written communication in professional and personal work.
CO4. Students will use correct and appropriate language in oral and written communication

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	2	3	1	2	3	2	2	2	2	1
CO2	2	3	2	2	1	3	2	1	2	3	2	2	2	2	2
CO3	3	3	2	2	2	2	2	2	2	3	2	2	2	1	2
CO4	3	3	2	2	2	3	3	2	1	3	2	2	2	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech III Sem	IPUCTO2	Introduction to Industrial Engineering	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

1. To impart capability of successfully planning, controlling, and implementing projects.
2. To apply the principles of engineering science, maths, technology and human engineering, involving industry-relevant problems.
3. To contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches and systems thinking methodologies.
4. To recognize the tools of efficiency, effectiveness and productivity for the resources of the plant and facility.
5. To implement the policy of wage administrations for making the labour more and higher productive in their work.

COURSE CONTENT:

Module-I

Introduction: History & development of industrial engineering. Productivity, means of increasing productivity, work study, productivity and work study, human factor in the fabrication, work of F. W. Taylor, Frank and Lillian Gilberth and their contribution.

Module-II

Method study: Definition & basic procedure, selection of jobs. Recording technique: micro motion study, Therbligs, cyclograph,chronocyclo graph, principle of motion economy, design of work place layout, analysts in the form of chart, operation chart, flow process chart, flow diagram, string diagram, man machine chart, two hand chart, Simo chart.

Module-III

Work measurement: Definition, objectives, application, number of cycles to be timed, time study equipment, performance rating, allowance, lumber of cycle to be studied, determination of standard time, predetermined motion time system, conducting work sampling study & establishing standard time.

Module-IV

Wages & incentives: Characteristics of a good wage or incentive system, method of wage payment, concept of wage & incentive schemes, financial and non-financial: Taylor's differential piece rate, Halsey premium plane, Merric's multiple piece rate system, group incentive scheme.

Ergonomics: Work space dimension, design of work place, environmental stresses & impacts on human work.

Module-V

Value engineering: Introduction, concept of value, value analysis approaches, job plan, value tests.

Industrial safety: Analysis of cost of accident, hazards in various fields like fire, electrical shocks, chemical; organization for safety, plant safety, govt. legislation for safety, safety rules.

TEXT & REFERENCE BOOKS:

1. Introduction to work study–I.L.O., Oxford Press.
2. Motion and time study – Mundel, Prentices Hall India.
3. Motion and Time Study– Ralph M Barnes, John Wiley and sons.
4. Industrial Engineering – M. I. Khan, New Age International Publication.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to apply mathematics and science in Industrial engineering.

CO2: Ability to design and conduct experiments, as well as to analyse and interpret data.

CO3: Ability to identify, formulate and solve engineering problems.

CO4: Ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering practice.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	3	2	2	2	2	-	2	2	2	2	2	3	2	3
CO2	3	2	2	2	2	2	-	2	-	-	2	1	3	2	2
CO3	3	3	2	2	2	-	-	3	-	-	2	2	2	3	-
CO4	3	3	2	3	3	1	1	2	1	-	2	1	3	2	-
CO5	3	3	2	2	2	-	-	2	2	-	1	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P				
B. Tech III Sem.	IPUCLT2	Mechanics of Materials Lab	-	-	2	25	25	50	1

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Ability to communicate effectively the mechanical properties of materials

LIST OF EXPERIMENT (Minimum 10 experiments to be performed):

1. To perform torsion test on mild steel specimen.
2. To perform bending tests on simply supported beam and cantilever beam.
3. To perform compression test on concrete.
4. To perform impact test.
5. To perform shear test.
6. Investigation of Hook's law that is the proportional relation between force and stretching in elastic deformation.
7. Determination of torsion and deflection.
8. Measurement of forces on supports in statically determinate beam.
9. Determination of shear forces in beams.
10. Determination of bending moments in beams.
11. Measurement of deflections in statically determinate beam.
12. Measurement of strain in a bar.
13. To perform bend test on steel bar.
14. To determine yield/tensile strength of steel bar.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1. Perform the function on multi-disciplinary teams in the area of materials testing.

CO2. Use the techniques, skills and modern engineering tools necessary for engineering.

CO3. Apply professional and ethical responsibility in the areas of material testing.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	-	-	-	-	-	-	2	2	1	2
CO2	3	3	1	3	2	-	-	-	-	-	-	2	1	2	2
CO3	3	2	1	3	2	-	-	-	-	-	-	2	2	1	2

1: Slight (Low); 2: Moderate (Medium); 3: Substantial (High);

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P				
B. Tech III Sem.	IPUCLT3	Theory of Machines Lab	-	-	2	25	25	50	1

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Proficiency in the use of mathematical methods to analyze the forces and motion of complex systems of linkages, gears and cams.
2. Design linkage, cam and gear mechanisms for a given motion or a given input/output motion or force relationship.
3. Analyze the motion and the dynamical forces acting on mechanical systems composed of linkages, gears and cams.

LIST OF EXPERIMENTS (Minimum 10 experiments to be performed):

1. To study about the Oldham Coupling Mechanism with the help of Virtual-LAB.
2. To study about the quick return mechanism with the help of Virtual-LAB.
3. To study about the CAM follower mechanism with the help of Virtual-LAB.
4. Position analysis of Slider crank mechanism with the help of Virtual-LAB.
5. Velocity analysis of Slider crank mechanism with the help of Virtual-LAB.
6. To study about theElliptical Cam Mechanism with the help of Virtual-LAB.
7. To study about theCrank and Slotted Mechanism with thehelp of Virtual-LAB.
8. To study about theUniversal Joint with thehelp of Virtual-LAB.
9. To determine the jump phenomena of cam follower apparatus.
10. To draw displacement, velocity and acceleration curve of cam motion
11. To find the speed and torque of different gear in an epicyclic gear train.
12. To Study and analysis of Pantograph.
13. To study Four-bar mechanism and its inversions.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Identify mechanisms in real life applications.
CO2: Perform kinematic analysis of simple mechanisms
CO3: Perform static and dynamic force analysis of slider crank mechanism.
CO4: Determine moment of inertia of rigid bodies experimentally.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	3	2	-	-	-	-	-	-	2	2	1	2
CO2	3	2	1	3	2	-	-	-	-	-	-	2	1	2	2
CO3	3	2	1	3	2	-	-	-	-	-	-	2	2	1	2
CO4	3	2	1	3	2	-	-	-	-	-	-	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
NEP 2020–Scheme of Teaching & Examination
W.E.F. Session: 2024-2025
B. TECH SECOND YEAR, IV SEMESTER

SN	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
1	IPUDTT3	Industrial Engineering	3	–	–	40	60	100	3
2	IPUDTT4	Fluid Engineering	3	–	–	40	60	100	3
3	IPUDTT5	Manufacturing Process-I	3	–	–	40	60	100	3
4	IPUDTT6	Engineering Mathematics-C	3	–	–	40	60	100	3
5	IPUDTP_	*Professional Elective-1/2*	3	–	–	40	60	100	3
6	_UDTO_	*Open Elective*	3	–	–	40	60	100	3
Total			**18**	–	–	**240**	**360**	**600**	**18**
PRACTICALS									
1	IPUDLT3	Fluid Engineering Lab	–	–	2	25	25	50	1
2	IPUDPF1	Mini Project	–	–	4	50	50	100	2
Total			**–**	**–**	**6**	**75**	**75**	**150**	**3**
GRAND TOTAL			**18**	**-**	**6**	**315**	**435**	**750**	**21**

List of Department/ Professional Elective		
SN	Course No.	Subject
1.	IPUDTP1	Material Management
2.	IPUDTP2	Safety Management and Labour Law

Institute Core/ Open Elective offered by the Department			
SN	Course No.	Subject	Offering Department
1.	IPUDTO2	Introduction to Manufacturing Processes	IPE

Internal Assessment: – Two class tests of 15 marks each will be conducted. Moreover, 5 marks will be for attendance and 5 marks are allocated for the Assignments, surprise test, quiz test etc.

Approved in BOS meeting held on 28.06.2024

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech IV Sem	IPUDTT3	Industrial Engineering	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To impart capability of successfully planning, controlling, and implementing projects.
2. To apply the principles of engineering science, maths, technology and human engineering, involving industry-relevant problems.
3. To contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches and systems thinking methodologies.
4. To recognize the tools of efficiency, effectiveness and productivity for the resources of the plant and facility.
5. To implement the policy of wage administrations for making the labour more and higher productive in their work.

COURSE CONTENT:

Module-I

Introduction: History & development of industrial engineering. Productivity, means of increasing productivity, work study, productivity and work study, human factor in the fabrication, work of F. W. Taylor, Frank and Lillian Gilberth and their contribution.

Module-II

Method study: Definition & basic procedure, selection of jobs. Recording technique: micro motion study, Therbligs, cyclograph,chronocyclo graph, principle of motion economy, design of work place layout, analysts in the form of chart, operation chart, flow process chart, flow diagram, string diagram, man machine chart, two hand chart, Simo chart.

Module-III

Work measurement: Definition, objectives, application, number of cycles to be timed, time study equipment, performance rating, allowance, lumber of cycle to be studied, determination of standard time, predetermined motion time system, conducting work sampling study & establishing standard time.

Module-IV

Wages & incentives: Characteristics of a good wage or incentive system, method of wage payment, concept of wage & incentive schemes, financial and non-financial: Taylor's differential piece rate, Halsey premium plane, Merric's multiple piece rate system, group incentive scheme.

Ergonomics: Work space dimension, design of work place, environmental stresses & impacts on human work.

Module-V

Value engineering: Introduction, concept of value, value analysis approaches, job plan, value tests.

Industrial safety: Analysis of cost of accident, hazards in various fields like fire, electrical shocks, chemical; organization for safety, plant safety, govt. legislation for safety, safety rules.

TEXT BOOKS:

1. Introduction to work study–I.L.O., Oxford Press.
2. Motion and time study – Mundel, Prentices Hall India.
3. Motion and Time Study– Ralph M Barnes, John Wiley and sons.
4. Industrial Engineering – M. I. Khan, New Age International Publication.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to apply mathematics and science in Industrial engineering.

CO2: Ability to design and conduct experiments, as well as to analyse and interpret data.

CO3: Ability to identify, formulate and solve engineering problems.

CO4: Ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering practice.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	3	2	2	2	2	-	2	2	2	2	2	3	2	3
CO2	3	2	2	2	2	2	-	2	-	-	2	1	3	2	2
CO3	3	3	2	2	2	-	-	3	-	-	2	2	2	3	-
CO4	3	3	2	3	3	1	1	2	1	-	2	1	3	2	-
CO5	3	3	2	2	2	-	-	2	2	-	1	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech IV Sem	IPUDTT4	Fluid Engineering	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Developed the concept of fluid mechanics and statics, buoyancy, and the application of pressure measuring devices during fluid flow.
2. The importance of fluid flow and stream line related to kinematics.
3. Established the importance of energy equations in dynamic analysis of fluid flow and to developed the fundamentals of flow measuring devices and their industrial application.
4. The importance of dimensional, model and similitude in prototype design.
5. Knowledge of flow systems in pipes and to determine the losses in a flow system.

COURSE CONTENT:

Module – I

Introduction of Fluid mechanics: Introduction, continuum, density, specific weight, specific gravity, kinematic and dynamic viscosity, variation of viscosity with temperature, Newton's law of viscosity, Bulk modulus of elasticity, compressibility, vapour pressure, cavitation, surface tension, capillary action.

Fluid Statics: Pascal's law, hydrostatic pressure and force on horizontal, vertical, and inclined surfaces. Buoyancy and concept of submerged and floating bodies.

Pressure measuring devices: single column and U–tube manometer.

Module – II

Fluid Kinematics: Classification of fluid flow: steady and unsteady flow, uniform and non– uniform flow, laminar and turbulent flow, rotational and irrotational flow, compressible and incompressible flow, ideal and real fluid flow,

one, two and three dimensional flows. Stream line, path line, streak line and stream tube, stream function, velocity potential function.

Module – III

Fluid Dynamics: Surface and body forces, equations of motion, Euler's equation, Bernoulli's equation, derivation, energy principle, practical applications of Bernoulli's equation, continuity and momentum equations, momentum principle, forces exerted by fluid flow on pipe bend.

Flow measuring devices: Venturimeter, Orificemeter, and Pitot tube.

Module – IV

Dimensional analysis and dynamic similitude: Reynolds number, Froude number, Mach number, Weber number and Euler number, Rayleigh's method, Buckingham's π–theorem. Model studies: similitude, dimensionless number and its significance.

Module – V

Laminar Flow: flow of viscous fluids in circular pipe, shear stress and pressure gradient relationship, velocity distribution, Hagen-Poiseuille equation, Coutte flow, pressure head drop.

Turbulent Flow: Effect of turbulence, Darcy-Weisbach equation.

Flow through pipe: Energy losses in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe power transmission through pipe.

TEXT & REFERENCE BOOKS:

1. Fluid Mechanics Fundamental and applications– Yunus A. Cengel, John M. Cimbala, McGraw Hill Edu., 2015.
2. Fluid Mechanics - Frank M. White, Henry Xue, McGraw Hill Edu., 9th edition, 2022.
3. Fluid Mechanics with Engineering Applications - E. John Finnemore, Joseph B. Franzini, McGraw Hill Edu., 10th edition
4. Hydraulics and Fluid Mechanics – P. M. Modi and S. M. Seth, Standard Book House.
5. Textbook Of Fluid Mechanics & Hydraulic Machines – Sukumar Pati, McGraw Hill, 2022.
6. Introduction to Fluid Mechanics and Fluid Machines - S K Som, Gautam Biswas, Suman Chakraborty, McGraw Hill Edu., 3rd Edition, 2017
7. Theory and Applications of Fluid Mechanics – K. Subramanya, Tata McGraw Hill.
8. Fluid Mechanics and fluid power Engineering - D.S Kumar, S.K. Kataria and sons, 2015
9. Fluid Mechanics with Engineering Applications – R.L. Daugherty, J.B. Franzini and E. J. Finnemore, International Student Edition, McGraw Hill

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Develop the concept of fluid statics and solve the related to fluid properties and to analyse the stability of a floating body.

CO2: Differentiate among various categories of fluid flow and its importance.

CO3: Derive Euler's equation of motion and deduce Bernoulli's equation and analyze the pressure heat for incompressible fluids.

CO4: Apply the similitude concept and set up the relation between a model and a prototype.

CO5: Evaluate the pressure drop and to develop, analyze the energy losses in pipe transitions, losses in pipes and able to sketch the energy gradient lines.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	3	2	3	-	-	1	-	-	-	-	1	3	2	2
CO2	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	1	2
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	2	1

Weightage 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech. IV Sem.	IPUDTT5	Manufacturing Processes -I	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Enable the students regarding foundry practices like pattern making, mould making, core making, etc. with detail design of gating/ riser system needed for casting for achieving sound casting
2. Understand the principle, concept, thermal and metallurgical aspects of melting and various special casting process applications.
3. Understand the principle of various welding processes and its industrial utilization
4. Enable the students regarding various Power Sources, its Selection, Welding Electrodes Types, their coatings, importance and selection.
5. Understand the principles of solid state welding process , radiant energy metal joining process, special arc welding and testing of weldment in industrial environment

COURSE CONTENT:

Module –I

Foundry: Moulding method and materials, sand-clay-water system, additives, pattern making and types, pattern allowances & design considerations, types of moulding sand & their properties, testing, cores and sand core boxes, core making, moulding machine.

Gating system: Elements & design of gating system, design of riser, solidification of casting.

Module –II

Melting furnaces and practices: Melting cast iron, steel and non-ferrous material, cupola, charge calculation, open furnaces, converter and crucible furnaces, electric, direct arc furnace, inductive furnace.

Special casting processes: Centrifugal and investment casting, shell, types and principle of die casting, squeeze casting, gravity and pressure die casting, die casting consideration, continuous casting, centrifugal casting, slush casting, casting defects.

Module –III

Welding: Classifications, principle and equipment of gas welding and Arc Welding, different type of welding process and their equipment, features, Welding symbols, Positions of welding, types of Gas welding Flames, Welding Techniques, Gas welding Torches Submerged Arc Welding, TIG, MIG, Plasma Arc Welding and its Application

Physics of welding: weldability, weld thermal cycle, Heat affected zone, Arc efficiency, temperature distribution in the arc; arc forces, arc blow, electrical characteristics of an arc, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc.

Module - IV

Arc Welding: Arc Welding Power Sources, Selection Factor for Power Sources, DC Generator, rectifiers, Constant Current & Constant Voltage Machines, welding Transformers, duty cycles

Welding Electrodes: Types, electrode coatings and its importance, selection of electrode, electrode coating ingredients and their functions, role of flux ingredients and shielding gases forces during metal transfer, modes of metal transfer in arc welding.

Module - V

Resistance welding process: Spot Welding, Seam, Projection, Butt welding, Flash Butt Welding, percussion welding.

Solid state welding process: Cold Welding, Diffusion Welding, Ultrasonic Welding, Explosive Welding, and Friction Welding'

Radiant energy welding process: Electrical Beam Welding, Laser Beam Welding.

Welding distortion: Distortion and Residual Stresses, Types, Control of welding Distortion, Various discontinuities in welds, Trouble shooting.

Brazing, Soldering and their Application

Testing, Inspection and Specification: Non-destructive methods of testing weldment,

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for engineering materials - Kalpakjian and Schmid, Pearson India.
2. Manufacturing Science- A. Ghosh and A. K. Mallik, East-West Press Pvt. Ltd. New Delhi.
3. Manufacturing Technology (Foundry, Forming and Welding) – P. N. Rao, Tata McGraw Hill Publishing Company.
4. Materials and Processes in Manufacturing - E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi.
5. Production Engineering Sciences - P. C. Pandey and C. K. Singh, Standard Publishers Ltd.
6. Modern Arc Welding Technology - S.V. Nadkarni, Oxford IBH Publishers.

7. Welding and Welding Technology - R.L. Little, Tata McGraw-Hill.
8. Welding Technology - O.P, Khanna Dhanpat Rai & Sons.
9. Welding Processes & Technology- R.S. Parmar, Khanna Publishers.
10. Manufacturing Technology (Foundry, Forming and Welding Vol. 1) - P. N. Rao, Tata McGraw Hill.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1. Evaluate foundry practices like pattern making, mould making, core making, etc., Select appropriate design of gating systems and manufacturing processes in order to design products.

CO2. Apply the principle, concept, thermal and metallurgical aspects of melting and selection of various special casting processes

CO3. Select various welding processes according to the weldment requirement

CO4. To evaluate various Power Sources, its Selection, Welding Electrodes Types, their coatings, importance and selection.

CO5. Understand and apply the principles of solid state welding process, radiant energy metal joining process, special arc welding and testing of weldment in industrial environment

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	-	-	-	-	-	2	1	2	2	2
CO2	3	2	1	2	-	-	-	-	-	-	2	2	2	2	2
CO3	3	2	2	2	-	-	-	-	-	-	2	2	2	2	2
CO4	3	2	2	2	-	-	-	-	-	-	2	2	2	2	2
CO5	3	1	2	2	-	-	-	-	-	-	2	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech. IV Sem.	IPUDTT6	Engineering Mathematics-C	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

This course will enable the students to:

1. Understand the Laplace Transforms, properties of Laplace Transform, inverse Laplace Transform and some applications to solve the differential equations.
2. Understand the fundamental concepts of Complex Analysis which will enrich them to have a good knowledge to apply in real life problems.
3. Solve algebraic, transcendental equations and system of linear equations and ordinary differential equations.
4. Use the basic probability rules, including additive and multiplicative laws, adopt the knowledge of various Probability distributions and their applications.
5. Explain the basic ideas of measures of central tendency, dispersion correlation and regression.

COURSE CONTENT:

Unit-I

Laplace Transform: Laplace and inverse Laplace transforms, and their properties. Application of Laplace transforms to ordinary linear differential equations.

Unit-II

Functions of Complex Variables: Cauchy-Riemann equations, Analytic functions, Complex integration, Cauchy‘s integral theorem, Cauchy’s integral formula, Taylor series,

Unit-III

Numerical Methods: Numerical solutions of linear and nonlinear algebraic equations, Integration by trapezoidal and Simpson’s rules, Solution of ordinary differential equations by Picard and Taylor’s methods

Unit-IV

Basics of Probability: Definitions of Probability and Probability Theorems, conditional probability, random variables binomial, Poisson , normal and exponential distributions

Unit-V

Statistics: Mean, Median, mode and standard deviation, correlation and regression.

TEXT & REFERENCE BOOKS:

1. Fundamental of Mathematical Statistics– S. C. Gupta and Kapoor, Sultan Chand and Sons, 1980.
2. Mathematical Statistics –M. Ray.
3. Higher engineering mathematics. B.S. Grewal*, Khanna Publishers, New Delhi*
4. Numerical Methods in Engineering & Science with Programs in C, C++ & MATLAB, B.S. Grewal, Khanna Publishers.
5. Numerical Methods, P. Kandasamy, K. Thilagavathy, K. Gunavathi, S. Chand and Company Ltd.

COURSE OUTCOMES:

At the end of the course the students will be able to:

Course Outcomes: Upon successful completion of this course, students will be able to:

CO1: Solve the differential equations by Laplace transform.
CO2: Identify the nature of complex analytic functions and find complex integration.
CO3: Solve different kind of equations numerically
CO4: Solve the problems regarding uncertainty.
CO5: Analyze the data and draw the valid conclusions.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	3	1	2	1	2	2	2	3	3	2	2	2
CO2	3	3	1	3	1	2	1	2	2	2	3	3	2	2	2
CO3	3	3	1	3	1	2	1	2	2	2	3	3	2	2	2
CO4	3	3	1	3	1	2	1	2	2	2	3	3	2	2	2
CO5	3	3	1	3	1	2	1	2	2	2	3	3	2	2	2

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech. IV Sem.	IPUDTP1	Material Management	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To provide the concept of effective and efficient purchase, various inventory policies and models.
2. To provide the concept of effective and efficient store management by implementing modern techniques like JIT and MRP.
3. To provide the concept of various models of inventory control.

COURSE CONTENT:

Module - I

Introduction: Definition and history of material management, concept of integrated materials management, materials research, materials planning and budgeting, codification, standardization.

Purchasing: Objective and function of purchasing department, purchasing procedure, negotiation and source-selection.

Module - II

Types of purchasing: Buying seasonal commodities, purchasing under uncertainty, purchasing of capital equipment, international purchasing, public buying, legal concept in buying, insurance buying, price forecasting.

Module-III

Stores management: Stores system and procedure, incoming material control, stores accounting and stock verification, obsolete, surplus and scrap management.

Module - IV

Basic inventory system: Concept of inventory, types of inventory, economic order quantity, inventory control techniques, basic models of inventory.

Spare parts management: Definition of spares and its classification, MUSIC-3D, view of spares, multi echelon spares inventory.

Module - V

Value analysis: Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, uses, Applications, advantages and limitations of Value analysis. Symptoms to apply value analysis,

TEXT & REFERENCE BOOKS:

1. Materials Management an integrated approach – P. Gopalkrishnan. & M Sundaresan (2002) Prentice Hall India Limited, New-Delhi.
2. Materials Management Text and Cases - A.K Chitlae & R..C. Gupta (2009) Prentice Hall India Limited, New-Delhi.
3. Maintenance and Spare parts Management – Pathak, Prentice Hall India Limited, New Delhi.
4. Production and Operations Management - S.N. Chary, Tata McGraw Hill.
5. Material management: An integrated approach - Dutta.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Develop an ability to perform the role of a materials manager in an organization.

CO2: Manage the activities of materials manager like purchasing, inventory analysis, storage etc.in a scientific manner.

CO3: Improve due date performance through use of MRP techniques with in capacity constraints.

CO4: Practice material planning through modern materials management tools like JIT, DBR etc.

CO5: Understand ethical issues in purchasing and negotiations

Mapping of Course Outcomes (CO) onto Program Outcomes (PO) and Program Specific Outcomes (PSO):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	3	3	1	-	-	-	-	-	1	-	-	-	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	1	2	2	3
CO3	3	3	3	1	-	-	-	-	-	-	-	2	1	2	3
CO4	3	2	3	1	-	-	-	-	-	1	1	2	2	1	2
CO5	3	3	2	1	-	-	-	-	-	1	-	-	-	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech. IV Sem.	IPUDTP2	Safety Management and Labour Law	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To understand roles, responsibilities, importance of health safety and welfare in work places.
2. To impart knowledge about material handling, air pollution control system, fire prevention and protection.
3. To learn about safety audit, disaster control, safety principles.
4. To understand the labour laws and various acts, applicable to industries.

COURSE CONTENT:

Module-I

Safety management: Concept's evolution of modern safety concept, safety policy, safety in organization, line and staff functions for safety, safety committee, budgeting for safety, techniques incident recall technique (IRT), disaster control, job safety analysis (JSA), safety survey, safety inspection, safety sampling, safety audit.

Safety in material handling: Ergonomic consideration in material handling, design, installation, operation and maintenance of conveying equipment, hoisting, traveling and slewing mechanisms.

Module-II

Design of air pollution control system: Industrial sources of air pollution, emission factors, regulations control strategies, policies, gaseous pollutant control: gas absorption in tray and packed towers, absorption with/without chemical reaction, removal of SO_2, absorption in fixed blades- breakthrough, removal of HCs/VOCs, NOx removal, wet scrubbers.

Integrated air pollution control systems: Pollution control in process industries, pollution control in process industries like cement, paper, petroleum, petroleum products, textile, tanneries, thermal power plants dying and pigment industries, eco-friendly energy.

Module –III

Industrial Safety - Industrial accidents, causes and effects, safety devices in machines, electrical hazards and protections, personal protective devices**.**

Fire prevention and protection: Sources of fire , fire triangle, principles of fire extinguishing, active and passive fire protection systems, various classes of fires, A, B, C, D, E, types of fire extinguishers, fire stoppers, hydrant pipes, hoses, monitors, fire watcher's layout of stand pipes, fire station, fire alarms and sirens

Module-IV

Industrial relations – Industrial disputes, reasons and methods of settling Industrial disputes, Trade unions and its functions, rules. Handling of workers grievances, steps in handling of workers grievances, workers participation in mgmt. need and forms of workers participation in mgmt.

Industrial psychology - meaning and roles of Industrial psychology , importance in labor mgmt.

Module-V

Industrial legislations –meaning and classifications , Industrial acts , The factory act 1948, workers compensations act 1923 , minimum wages act 1948 ESI Act 1948 , industrial dispute Act 1947 , the payment of wages Act 1936 , Mining Act 1948 , and various amendment in acts .

TEXT& REFERENCEBOOKS:

1. Accident Prevention Manual for Industrial Operations,N.S.C.Chicago,1982.
2. Industrial Accident Prevention, H.W Heinrich,1980, McGraw-HillCompany, New York.
3. HandBook of Fire Technology, R.S.Gupta, Orient Longman,1977,Bombay.
4. Accident Prevention manual for industrial operations,N.S.C.Chicago,1982.
5. Fire and explosion protection, Dinko Tuhtar.

COURSE OUTCOMES:

After completion of the course, the students will be able to

1. To acquire the knowledge of substantive as well as procedural contents of safety management and labour laws.
2. To develop an insight into the wages law, factory act etc.
3. To gather an understanding of natures of accidents and its effects.
4. To gather an understanding of natures of various types of hazards in industry.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	2	3	1	-	2	2	-	2	-	2	2	3	2	3
CO2	3	2	2	2	-	3	2	-	-	-	2	1	3	2	2
CO3	3	3	2	3	-	2	3	-	-	-	2	2	2	3	2
CO4	3	3	3	3	-	2	2	-	1	-	2	2	3	2	2
CO5	3	3	3	2	-	2	2	-	2	-	2	2	2	2	-

- **1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)**

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA						
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance	SEA		
B. Tech. IV Sem.	IPUDTO2	Introduction to Manufacturing Processes	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Enable the students regarding foundry practices like pattern making, mould making, core making, etc, along with design of gating system needed for creating defects free casting.
2. Understand the principle, concept, thermal and metallurgical aspects of melting
3. Demonstrate about principles/ methods of various special casting processes for achieving sound casting.
4. Analyse various metal forming processes and plastic deformation during forming processes.
5. Build knowledge about design criteria, their fundamental working principles, criteria of selection and application of jigs and fixtures.

COURSE CONTENT:

Module –I

Foundry: Moulding method and materials, sand-clay-water system, additives, pattern making and types, pattern allowances & design considerations, types of moulding sand & their properties, testing, cores and sand core boxes, core making, moulding machine.

Gating system: Elements & design of gating system, design of riser, solidification of casting.

Module –II

Melting furnaces and practices: Melting cast iron, steel and non-ferrous material, cupola, charge calculation, open furnaces, converter and crucible furnaces, electric, direct arc furnace, inductive furnace.

Module –III

Special casting processes: Centrifugal and investment casting, shell, types and principle of die casting, squeeze casting, gravity and pressure die casting, die casting consideration, continuous casting, centrifugal casting, slush casting, casting defects.

Module –IV

Metal forming: Need and classification, elastic and plastic deformation, yield criteria, fundamentals of hot and cold working processes, conceptual understanding of Drawing, Rolling, forging, Extrusion.

Module –V

Work holding device: Introduction to jigs, fixtures and their types, design criteria, economic justification, fundamental principles of design of jigs and fixtures.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for engineering materials - Kalpakjian and Schmid, Pearson India.
2. Manufacturing Science- A. Ghosh and A. K. Mallik, East-West Press Pvt. Ltd. New Delhi.
3. Manufacturing Technology (Foundry, Forming and Welding) – P. N. Rao, Tata McGraw Hill Publishing Company.
4. Materials and Processes in Manufacturing - E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi.
5. Production Engineering Sciences - P. C. Pandey and C. K. Singh, Standard Publishers Ltd.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Evaluate foundry practices like pattern making, mould making, core making, design of gating systems, etc.
CO2: Apply the principle, concept, thermal and metallurgical aspects of melting
CO3: select of various special casting processes in accordance to requirement and feasibility.
CO4: Evaluate the effect of process parameters on the process mechanics during bulk metal forming
CO5: Select appropriate jigs and fixtures in various engineering applications.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	2	1	2	2	2
CO2	3	2	1	-	-	-	-	-	-	-	2	2	3	3	3
CO3	3	2	2	-	-	-	-	-	-	-	2	3	2	3	3
CO4	3	2	2	-	-	-	-	-	-	-	2	2	2	3	3
CO5	3	1	2	-	-	-	-	-	-	-	2	2	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P				
B. Tech IV Sem.	IPUDLT3	Fluid Engineering Lab	-	-	2	25	25	50	1

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Provide practical knowledge in verification of principles of fluid flow.
2. Demonstrate the classical experiments in fluid mechanics.
3. Correlate various flow measuring devices such as Venturimeter, orifice meter and notches etc.
4. Impart knowledge in measuring pressure, discharge and velocity of fluid flow
5. Explain practically the major and minor losses.

LIST OF EXPERIMENT:

1. Measurement of viscosity.
2. Study of pressure measuring devices.
3. To determine the stability of floating body.
4. To determine hydrostatics force on flat surfaces/curved surfaces.
5. To verify the Bernoulli's theorem.
6. To determine flow rate using Venturimeter.
7. To determine flow rate using Orifice meter.
8. Velocity distribution in pipes.
9. To study Laminar flow in a pipeline.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Present experimental results in the form of written report.
2. Measure pressure, velocity and flow rate.
3. Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
4. Analyze practical problems related to peer industries such as power plants, chemical industries etc.
5. Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	-	1	-	-		-	-	-	-	-
CO2	2	2	-	-	1	-	-	-	-	-	-	-	1	1	2
CO3	2	-	1	1	1	-				1	-	-	1	2	-
CO4	1	1	1	-		-	-	-	-	-	-	-	1	-	2
CO5	1	1	-	3	1	-	-	-	-	-	-	-	1	1	1

Weightage: 1-Sightly, 2-Moderately, 3-Strongly

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
NEP 2020 –Scheme of Teaching& Examination
W.E.F. Session: 2024-2025
B. TECH THIRD YEAR, V SEMESTER

SN	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
1	IPUETT1	Machining and Machine Tool	3	–	–	40	60	100	3
2	IPUETT2	Machine Design	3	–	–	40	60	100	3
3	IPUETT3	Operation Research	3	–	–	40	60	100	3
4	IPUETP_	*Professional Elective-1/2*	3	–	–	40	60	100	3
5	IPUETP_	*Professional Elective-3/4*	3	–	–	40	60	100	3
6	IPUETP_	*Professional Elective-5/6*	3	–	–	40	60	100	3
Total			**18**	–	–	**240**	**360**	**600**	**18**
PRACTICALS									
1	IPUELT1	Machining and Machine Tool Lab	–	–	2	25	25	50	1
2	IPUELT2	Modelling and Simulation Lab	–	–	2	25	25	50	1
3	IPUEPF1	Mini Project	–	–	4	50	50	100	2
Total			**–**	**–**	**8**	**100**	**100**	**200**	**4**
GRAND TOTAL			**18**	**-**	**8**	**340**	**460**	**800**	**22**

List of Department/ Professional Elective		
S.N	Course No.	Subject
1. 2.	IPUETP1 IPUETP2	Lean Manufacturing Fluid Machinery
1. 2.	IPUETP3 IPUETP4	Mechatronics Managerial Economics
1 2	IPUETP5 IPUETP6	Organization Management Financial Management

Internal Assessment: – Two class tests of 15 marks each will be conducted. Moreover, 5 marks will be for attendance and 5 marks are allocated for the Assignments, surprise test, quiz test etc.

Approved in BOS meeting held on 28.06.2024

Course Name & Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETT1	Machining and Machine Tool	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

1. Understanding the technical aspect related to metal cutting and tool geometry.
2. Gaining the knowledge of importance of machinability, the impact of heat generation over machined surface and importance of tool life.
3. Provide insights towards, cutting tool materials, cutting fluid, and Economics of Machining.
4. Acquainted and familiarize with Lathe, Drilling, Milling, Shaper, planner and slotter machining process
5. Understanding of Jigs and fixtures – principles, applications, and design

COURSE CONTENT:

Module -I

Introduction: Definition and classification of metal cutting and tools, geometry of single point and multipoint cutting tool, various angles of cutting tool and their functions, factors affecting tool geometry, orthogonal and oblique cutting ,cutting tool signature, types of chips, their formation and factors. Merchant's force diagram.

Mechanism of chip formation: Forces on the chips, methods of chip breaking, Design principal of simple step type chip breaker, working principle of chip breakers, effect of chip breaking, Merchant theory and other theories of metal cutting, stresses and strain in chips, shear and strain rate, Power and energy calculation.

Module -II

Heat generation and cutting temperature in machining: Causes and sources of heat in cutting, heat distribution, their measurernent, tool dynamometer and their types and working.

Tool failures and tool life, mechanism of tool failure, types of tool failure, tool wear and types, Taylors tool life Equations, relationship between tool life, cutting speed, feed, depth of cut, factors affecting tool life.

Machinability -Definitions, evaluations, factors affecting machinability, machinability index.

Module - III

Cutting fluids- functions characteristics and types of cutting fluids and their application, criteria for selection of cutting fluids'

Cutting tool materials- requirements, types and characteristics of various cutting tool materials, comparison and selections of cutting tool.

Economics of machining - cost analysis and optimization of machining, various parameters for calculation of machining cost'

Module - IV

Lathe Machine: Constructional features, specification, working principles of lathe, operations of lathe machine - turning, taper turning, thread cutting.

Drilling Machine: Geometry and nomenclature of twist Drill, Constructional features, types, specification, its working principle and its operations.

Milling Machine: Constructional features, specification and operations of milling machine, Geometry and nomenclature of plain milling cutter, operation of milling-gear cutting;

Shaper, planner and slotter machine: Constructional features, specification, and operations, Difference between shaper, planner and slotter.

Module - V

Jigs and fixtures – principles, applications, and design.

TEXT & REFERENCE BOOKS:

1. Serope Kalpakjian and Steven Schmidt , Manufacturing Processes for Engineering Materials, Pearson Education, 6th Edition
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Material. Processes, and systems, 2nd Edition, Wiley India, 2007
3. P.N. Rao, Manufacturing Technology – Metal Cutting and Machine Tools, McGraw Hill.
4. Hajra Choudhury, Elements of Workshop Technology–Vol.-I, Media Promoters and Publishers
5. Amitabha Battacharya , Metal Cutting Theory and Practice

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Interpret single point cutting tool, effect of angles, and mechanics of metal cutting and

CO2: To understand the principle of Mechanisms of chip formation, shear angle relations, and cutting forces in orthogonal cutting and machining economics.

CO3: Identify different tool material, cutting fluids; and Economics of machining.

CO4: Understand the working of Lathe, Drilling, Milling, Shaper, planner and slotter, its attachments, and operations for specific applications

CO5: Evaluate importance of Jigs and fixtures and its applications for specific applications..

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	3	3	1	2
CO2	3	3	3	-	-	-	-	-	-	-	-	2	3	1	2
CO3	3	2	3	-	-	-	-	-	-	-	-	3	3	1	2
CO4	3	2	2	-	-	-	-	-	-	-	-	3	3	1	2
CO5	3	2	3	-	-	-	-	-	-	-	-	2	3	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Name & Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETT2	Machine Design	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

6. To familiarize the various steps involved in the design process.
7. To evaluate the shape and dimensions of a component by considering various principles.
8. To satisfy functional and strength requirements.
9. To learn to use standard practices, catalogues, standard data and standard machine components.
10. To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
11. To develop an ability to identify, formulate, and solve engineering problems.

COURSE CONTENT:

Module - I

Basic design concepts and design against static loading: BIS System of Designation of materials and material selection for design, design/allowable stress, factor of safety (FoS),
Design Against Fluctuating Load: Stress Concentration, Stress Concentration Factors, Causes and remedy, Fluctuating Stresses Endurance Limit, Notch Sensitivity, Soderberg and Goodman Lines.

Module - II

Design of shafts and keys: Shaft subjected to twisting moment, bending moment, combined twisting moment and bending moment, fluctuating loads, design of shaft on the basis of rigidity. Flat and square keys, woodruff keys. Types of shaft coupling, Design of sleeve or muff coupling.

Module - III

Design of riveted, bolted and welded joints: Failure of riveted join, strength and efficiency of riveted joint, eccentrically loaded riveted joint. Bolted joint in tension,. Eccentrically Loaded Bolted Joints in Shear,. Stresses in butt and fillet welds, strength of welded joints, eccentrically loaded joint, welding joint subjected to Bending moment.

Module - IV

Design of clutches and brakes: Friction clutches, friction materials, torque transmitting capacity, single & multiple plate clutches, centrifugal clutches, Single Block or Shoe Brake Simple Band Brake,

Design of belt drive: Flat and V-belts, belt constructions, geometrical relationships for length of the belt, analysis of belt tensions, condition for maximum power.

Module - V

Design of spur gears: Spur gears**,** gear drives, classification of gears, selection of type of gears, force analysis, gear tooth failures, selection of material, number of teeth, face width, beam strength of gear tooth, effective load on gear tooth, estimation of module based on wear strength, Lewis equation.

TEXT & REFERENCE BOOKS:

6. Design of Machine Elements – V. B. Bhandari, TMH, New Delhi.
7. Mechanical Engineering Design - Shigley, J.E., Charles, R.M. and Richard, G.B., McGraw Hill, 2004.
8. Machine Design – Spott, TMH.
9. Machine Design – Khurmi & Gupta, Khanna Publisher.
10. Machine Design – Sharma & Agrawal, Dhanpat Rai Publications.
11. Design of Machine Elements – Sharma & Purohit, PHI.
12. Design Data: Data Book of Engineers, PSG College of Technology.
13. Machine Design - T.V. Sundararajamoorthy and N. Shanmugam, Anuradha Agencies, 2003.
14. Machine Design Data Book - V. B. Bhandari, TMH, New Delhi.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO6: Describe the design process, material selection, calculation of stresses

CO7: Design the solid, hollow shafts and to finding the critical conditions and effective use of key in shaft and couplings

CO8: Analyze riveted and bolted joints in eccentric loading and examine the welded joints for structural applications.

CO9: Demonstrate knowledge on brakes, clutches and belt drive used in different application under static loading.

CO10: Analyze the bending and wear conditions in spur gear and knowledge to summarize the failure criteria.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	-	-	-	-	-	-	-	2	2	2	3
CO2	3	3	3	1	-	-	-	-	-	-	-	2	2	2	3
CO3	3	3	3	1	-	-	-	-	-	-	-	2	2	2	3
CO4	3	3	3	1	-	-	-	-	-	-	-	2	2	2	3
CO5	3	3	3	1						-	-	2	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETT3	Operation Research	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES

1. To learn about the importance of decision making.
2. To design and analyze mathematical statement and equations.
3. To grasp importance of Network analysis, transportation problems

COURSE CONTENT

Module-I

Introduction to linear programming: Problem formulation, graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, duality and sensitivity analysis, maximization & minimization function with or without constraints, constrained and unconstrained nonlinear optimization, sack surplus & artificial, variable method, degeneracy problem, integer programming, hands on training software – SageMath.

Module-II

Mathematical statement of the transportation problem: Transportation model, method for basic feasible solution, Degeneracy & unbalance problem, Mathematical statement of the assignment problem, solution of assignment problem, travelling sales-man problem.

Module-III

Game theory: Rule of game, method of solving game, graphically &arithmetic, saddle point& without saddle point, dominance method, mixed strategies 2 X 2 game, 2 X N game, M X 2 game, 3 X 3 game (method of matrix's, method of linear programming etc).

Inventory: Introduction, classification, function, level, control techniques, models, various costs associated, EOQ, optimum lot sizing.

Module-IV

Introduction of queuing theory: Elements of queuing system, operating characteristics of a queuing system, Poisson arrivals & exponential service time, waiting time & idle time cost, single channel queuing theory, markovian queuing models, simulation, manufacturing applications, hands on training software – QTSolver.

Replacement problems: Requirement policy, replacement of items, machinery various themes, group replacement policy, MAPI methods.

Module- V

Network analysis: Introduction of PERT & CPM, computation of PERT, time estimation, measure of deviation & variation , probability of completing project, arrow diagram & critical path method, scheduling , cost analysis & crushing of network, Gantt chart, GERT.

TEXT & REFERENCE BOOKS

1. Operation Research Sharma & S D Kedarnath, Ramnath & Co Meerut.
2. Operation Research, Sasien Yaspan.
3. Operation Research – N. D. Vohra, TMH Publication.
4. Operation Research– Hira & Gupta, S. Chand & Co.
5. Operation Research – H. Gillette, TMH, New Delhi.
6. Operations Research – M. Taha, TMH, New Delhi.
7. Operations Research – Phillip Ravindran, Wiley Publications.

COURSE OUTCOMES

After completion of the course, the students will be able to

CO1: Apply knowledge of optimization for formulating and engineering, decision problems in work culture

CO2: Work effectively with engineering departments.

CO3: Reflects towards resource optimization and allocation

Course Outcomes and their mapping with Programme Outcomes and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	1	-	-	-	2	-	3	3	3	3
CO2	2	-	2	2	2	2	-	-	-	1	-	2	3	2	3
CO3	3	3	2	2	2	2	-	-	-	1	-	2	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Name & Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETP1	Lean Manufacturing	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

1. Detailed knowledge and information about lean manufacturing tools and their impact on Plant Productivity and Product Cost
2. The required skills to understand and/or audit lean implementation maturity in your plant across various departments in different processes to check for gaps and advice accordingly
3. Tools and techniques in the efforts to introduce lean practices within the organisation
4. A sense of achievement for contributing to organisational scalability and hence growth, in turn, demonstrating potential, talent and encouraging additional opportunities for higher roles and responsibilities
5. The necessary flexibility to adapt to change, without letting it affect the individual, team or organisational performance

COURSE CONTENT:

Module-I

Introduction Lean Manufacturing:

Introduction, Definitions of Lean manufacturing, explaining basic concepts, historical development, overview of Lean Principles / concepts / tools.

Module-II

Primary Tools of Lean manufacturing:

5-S, Workplace organization, Total Productive Maintenance, Process mapping/ Value stream mapping, Work cell.

Module-III

Secondary Tools of Lean manufacturing:

Objective and benefits of Secondary lean tool, Cause and Effect diagram, Pareto chart, Spider chart, Poka yoke, KANBAN, Automation, Single minute exchange of die (SMED), Design for manufacturing and assembly, Just in time (JIT), Visual workplace, OEE.

Module-IV

Tools and Techniques:

The seven traditional tools of quality, new management tools, concepts, methodology, applications to manufacturing, Bench marking, Reason to bench mark, Bench marking process, FMEA, Stages, and Types. Quality circles, Quality Function Deployment (QFD), Taguchi quality loss function, TPM, improvement needs, Cost of Quality, Performance measures.

Module-V

Lean Management:

Concepts and Frame Work of Lean Manufacturing, Characteristics, benefits to organizations, Management theory, six sigma, Why six sigma, case studies

TEXT & REFERENCE BOOKS:

1. Mitra A., "Fundamentals of Quality Control and Improvement", PHI, 2nd Ed., 1998.
2. J Evans and W Linsay, The Management and Control of Quality, 6'th Edition, Thomson, 2005
3. Besterfield, D H et al., "Total Quality Management", 3rd Edition, Pearson Education, 2008.
4. D. C. Montgomery, Design and Analysis of Experiments, John Wiley & Sons, 6th Edition,2004
5. Dale H.Besterfiled, "Total Quality Management", Pearson Education Asia.

COURSE OUTCOMES:

1. Identify types of waste in manufacturing system and systematic eliminate it.
2. Study and implement lean principles.
3. Able to implement primary and secondary lean tools in manufacturing system.
4. Analyze and implement objectives and drivers of lean production system to achieve cost reduction and efficient service of customer demands
5. Apply appropriate approaches to project using Lean tools and techniques.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1	-	-	-	-	-	-	1	1	1	3
CO2	3	3	1	3	1	-	-	-	-	-	-	-	2	2	1
CO3	3	2	2	1	3	-	-	-	-	-	-	-	2	1	1
CO4	3	2	1	2	2	-	-	-	-	-	-	1	1	1	2
CO5	3	1	3	1	1	-	-	-	-	-	-	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Course Name & Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETP2	Fluid Machinery	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Developed the concept of boundary layer theory and formulation of basic equations involved in impact of free jets.
2. To visualize flow patterns over a bank of cylinders, measurement of flow rate, pumping power of fluid flow through duct and reaction force of jet impact.
3. To demonstrate performance characteristics of turbines.
4. Concepts lying in construction, working, and performance of various pumps.
5. Importance of hydraulic machines and its industrial application.

COURSE CONTENT:

Module – I

Boundary layer concepts**:** Boundary layer thickness, types and characteristics, momentum equation, laminar and turbulent boundary layer.

Flow around submerged bodies: Force exerted by flowing fluid on a body: drag and lift; stream lined and bluff body, drag on sphere and cylinder, lift on circular cylinder and air foil.

Impact of free jets: Force exerted by the jet on stationary flat, curved plate, hinged plate, moving plate and moving curve vanes.

Module – II

Hydraulic Turbines: Classification of hydraulic turbines, impulse and reaction turbines, construction, working and analysis of Pelton, Francis and Kaplan turbines, work done, efficiencies, draft tube, specific speed, performance curves for turbines, governing of the hydraulic turbines, cavitations.

Module – III

Centrifugal Pumps: Pump classification, and selection criterion, construction, working principle, velocity vector diagrams, work done, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, pressure rise in impeller, characteristic curves, priming**,** cavitation.

Module -IV

Reciprocating Pumps: Principle, classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram and its variations, work saved by fitting air vessels.

Module – V

Axial flow pump: Construction, working principle, velocity vector diagrams, work done and its efficiency.

Hydraulic machines: Hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic jack, hydraulic lift, hydraulic ram, fluid couplings, fluid torque converter air lift pump, and jet pump.

TEXT & REFERENCE BOOKS:

1. Hydraulics and Fluid Mechanics – P. M. Modi and S. M. Seth, Standard Book House.
2. Textbook of Fluid Mechanics & Hydraulic Machines – Sukumar Pati, McGraw Hill, 2022.
3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som & G. Biswas, TMGH
4. Fluid Mechanics & Machinery–Agarwal, TMGH.
5. Fluid Mechanics & Machinery –Kothandraman & Rudra Mourthy, New Age Publication.
6. Fluid Mechanics and fluid power Engineering - D.S Kumar, S.K. Kataria and sons, 2015.
7. Experiment in Hydraulics & Hydraulic Machine –Shesha Prakash- PHI
8. Fluid Mechanics & Turbo Machine–Das- PHI
9. Fundamentals of Turbo Machine –Venkanna- PHI
10. Introduction to Hydraulics & Pneumatics–Ilargo & Soundarajan- PHI.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Acquire knowledge and hands-on competence in applying the concepts of fluid machinery in the design and development of mechanical systems.

CO2: Estimate head and pump efficiency under various operating conditions

CO3: Estimate the performance of impulse and reaction turbines and calculate the output power and turbine efficiency under various operating conditions

CO4: Discuss centrifugal and reciprocating pumps using velocity triangles

CO5: Calculate the flow characteristics and performance of hydraulic machines for real time applications

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	2	2	2	3	1	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	3	2	1	2	-	-	-	-	1	3	2	2
CO3	3	3	2	2	1	1	1	-	-	-	-	1	3	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	1	3	2	2
CO5	2	2	1	1	-	-	-	-	-	-	-	-	2	1	1

Weightage 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETP3	Mechatronics	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To acquire the knowledge of basics of mechatronics and their scope.
2. To acquire the knowledge of sensors and transducers.
3. Analyse fundamental of hydraulic and electrical actuators.
4. To acquire the knowledge of data acquisition system and control system.
5. To develop the ability to analyse and design mechatronics system.

COURSE CONTENT:

Module - I

Introduction to mechatronics: Sensors and actuators type, selection and interfacing, digital electronics and microprocessors in mechatronic systems, mechatronic systems modelling, analysis and control of analogue, digital and hybrid systems, mechatronic systems design principles.

Module - II

Introduction to mechatronics systems: Measurement systems, control systems, mechatronics approach.

Sensors and transducers: Introduction, performance, terminology, displacement, position and proximity, velocity and motion-fluid, pressure-temperature, sensors-light, sensors-selection of sensors –signal processing.

Module - III

Microprocessor: Introduction, architecture pin configuration, instruction set-programming of microprocessor using 8085, instructions interfacing input and output devices, interfacing d/a convertors and a/d converter, applications, temperature control, steeper motor control, traffic light controller.

Module - IV

Programmable logic controller: Introduction, basic structure, input/output processing, programming, mnemonics timers, internal relays and counters data handling, analog input/output selection of a plc.

Module - V

Design and mechatronics: Stages in designing mechatronic systems, traditional and mechatronic design, possible design solutions, case studies of mechatronic systems, pick and place robot, automatic car park system, engine, management system.

TEXT & REFERENCE BOOKS:

1. Mechatronics – HMT Ltd.Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Mechatronics – D.A Bradley, D. Dawson, N.C. Burn and A.J. Loader, Chapman and Hall.
3. Mechatronics – Singh & Joshi, PHI.

COURSE OUTCOMES:

The after completion of the course the student will be able to

CO1. Apply knowledge of mechatronics for understanding and solving engineering problems.

CO2. Acquire knowledge and hands-on competence in applying the concepts of mechatronics in the design and development of mechanical systems.

CO3. Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.

CO4. Identify, analyse and solve mechanical engineering problems useful to the society.

CO5. Work effectively with engineering and science teams as well as with multidisciplinary designs.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**POs**												**PSOs**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2								2	2	1	-
CO2	3	3	3	2	1							2	2	1	-
CO3	3	3	3	3	2							3	1	1	-
CO4	3	3	3	3	3							3	2	1	-
CO5	3	2	2	2	2	2						2	1	1	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETP4	Managerial Economics	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To prepare engineering student to analyse cost/revenue data and carry out economic analyses in the decision making.
2. Justify the process or reject alternatives/projects on an economic basis.
3. To prepare engineering students to function in the business and management side of professional engineering practice.

COURSE CONTENT:

Module - I

Introduction to managerial economics: Different area of managerial economics, micro and macroeconomics, nature and scope of managerial economics, demand analysis, law of demand and its exceptions, elasticity of demand: definition, types, measurement and significance of elasticity of demand, supply analysis, law of supply, elasticity of supply: definition, types, measurement and significance of elasticity of supply.

Module - II

Law of return: Revenue analysis, theory of production and cost analysis: production function, Cobb-Douglas production function, ACMS production function, investment function.

Cost analysis: Cost concept, opportunity cost, fixed vs. variable cost, explicit costs vs. implicit costs, out of pocket costs vs. imputed costs, break-even analysis **(**BEA**),** determination of break-even point (simple problem), managerial significance and limitation of BEA.

Module - III

Introduction to market & pricing policies: Element of market, types of market, concept of market, classification of market based on the nature of competition, types of competition, features of perfect competition, feature of imperfect competition, monopoly and monopolistic competition, price-output determination in case of perfect competition and monopoly.

Objectives and policies of pricing: Introduction, full cost or cost-plus pricing, differential pricing, going rate pricing, marginal cost pricing, trade association pricing, loss leadership pricing, administered pricing

Module - IV

Forms of business organization: Introduction, definition, essential element of good organization, principles of organization, formal and informal organisation, organisation structure, concept of ownership organization, types of

ownership, partnership, joint stock company, types of joint stock company, co-operative organization, public sector organisation.

Capital and capital budgeting: Capital and its classifications, need of working capital and its assessment, factors affecting working capital, fundamental of accounting, types of capital, method and sources of raising finance, nature and scope of capital budgeting, features of capital budgeting proposals, method of capital budgeting: payback method, accounting rate of return (ARR) and net present value method (simple problems).

Module - V

Fundamental of financial accounting: Nature of accounting, important accounting terminology, accounts and types of accounts, rules of debit and credit, system of book keeping, book of accounts, journal, ledger, trial balance, final account, trading account, profit and loss accounts and balance sheet.

Financial analysis through ratios: Classification of financial ratios, liquidity ratios, leverage ratios, activity ratios, profitability ratios, current ratio, acid test ratio, debt equity ratio, assets coverage ratio, debt service coverage ratio, inventory turnover ratio, debtor velocity ratio, creditor velocity ratio, gross profit ratio, net profit ratio, return on equity ratio.

TEXT BOOKS:

1. Managerial Economics –Yogesh Maheshwari, PHI.
2. Managerial Economics – Joel Dean, PHI.
3. Managerial Economics – Craig H. Petersen, W. Cris Lewis, Sudhir K Jain.
4. Financial Accounting For Management – Ambrish Gupta, Pearson Eduction.
5. Managerial Economics – H. Craig Peterson & W. Cris Lewis, PHI.
6. Managerial Economics – Suma Damodaran, Oxford University Press.
7. Managerial Economics and Financial Analysis – Aryasri, TMH.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

CO1: Utilise economics principles in consumption process and Analyse the impact of demand and supply on pricing of product and competition.

CO2: Evaluate the economic theories, cost concepts and pricing policies.

CO3: Efficient use of resources in production and take decision regarding optimum output

CO4: Describe market mechanism and analyse product market to take proper decisions

CO5: Recognize, quantify, and record the common business transactions, and analyze financial statements using ratio analysis.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	1	1	1	2	1	1	2	-	-	-	2	3	3	2	3
CO2	1	1	1	1	1	2	2	2	-	-	2	1	3	2	2
CO3	1	1	1	2	1	1	3	-	-	-	2	2	2	3	-
CO4	1	2	1	2	1	2	2	1	1	-	3	1	3	2	-
CO5	1	2	1	2	1	1	2	1	2	1	3	1	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETP5	Organization Management	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

1. To understand the basic concept, importance and nature of management.
2. To learn the nature and purpose of planning.
3. To understand the meaning, characteristics and typologyof the organization.
4. To learn the leadership qualities and the methods of directing for effective communication.
5. To learn the different methods of controlling the management activities.

COURSE CONTENT:

Module - I

Introduction: Importance of management, definition, the process of management , Management as a -Science or Art, manager v/s entrepreneur, types of managers managerial roles and skills, evolution of management- scientific, human relationship approach, system and contingency approaches, Span of management .

Module - II

Planning: Nature and purpose of planning, types of planning, objectives, setting objectives, policies, strategic management, planning tools and techniques, decision making steps & processes.

Module - III

Organization: Nature and purpose of organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, recruitment selection, training & development, performance management, career planning and management.

Module - IV

Direction and leadership: Directing, individual and group behaviour, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

Module – V

Types of business organizations, sole proprietorship, partnership, company, public and private enterprises, organization culture and environment, current trends and issues in management.

Controlling: System and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

TEXT & REFERENCE BOOKS:

1. Management, S.P. Robins & M. Couiter, 10th Edition, 2009, Prentice Hall India.
2. Management, Jaf Stoner, R.E Freeman and D.R Gilbert, 6th Edition, 2004, Pearson Education.
3. Principles of Management, P.C Tripathy & P.N. Reddy, 1999, Tata McGraw Hill.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Learn the basic concepts of managerial functions and current trends and issues in management.
- Explain the nature of planning with the help of tools and techniques.
- Learn the nature and purpose of organization structure and the whole management system.
- Explain the leadership qualities and learn the effective communication.
- Analyse and apply both qualitative and quantitative information to isolate issues and formulate best control methods.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-	2	-	2
CO4	3	1	1	-	-	-	-	-	-	-	-	-	2	1	2
CO5	3	1	-	1	2	-	-	-	-	-	-	-	2	1	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech V Sem	IPUETP6	Financial Management	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. The objective of this course is to inform the students about the basic concepts of financial management and contemporary theory and policy in order to master the concepts, theories and technique of financial management, which represents the condition of profitable business operations and survival respectively in the development of business subjects and the economy as a whole.
2. Students should acquire the basic knowledge by means of combining theoretical cognitions and practical attitudes to enable them the understanding of financial problems in business practice after completed the vocational studies.

COURSE CONTENT:

Module – I

Introduction: Scope and objective, organisation of finance function.

Time value risk and return and valuation of money: Valuation of long-term securities, various model of pricing.

Module – II

Statement of changes in financial position: Sources and uses of working capital, cash flow statement, balance sheet, profit loss account and its process.

Financial ratio analysis: Meaning, types, importance and limitations**,** calculation of various ratios.

Module – III

Capital budgeting: Principals, techniques**,** various methods of capital budgeting, concept and measurement of cost and capital, and various approaches for measurement of cost of capital and computation.

Analysis of risk and uncertainty: Various approaches for risk evaluation.

Module – IV

Theory of working capital management: Concept and definition of gross, working capital and net working capital, trade-off between profitability and risk.

Module – V

Operating, financial and combined leverage: Introduction, definition and concept and various approaches.

TEXT BOOKS:

1. Financial Management – Khan and Jain, TMGH.
2. Financial Management – Kuchhal, Vikas Publication.
3. Financial Management – Paresh Shah, Willey India Pvt. Ltd

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Start and manage new business.

CO2: Evaluate and monitor short term and long-term investments.

CO3: Evaluate and monitor current asset.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**POs**												**PSOs**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	1	3	2	3	3	2	2	1
CO2	-	-	-	-	-	-	-	1	2	3	2	3	2	-	1
CO3	-	-	-	-	-	-	-	-	2	2	3	2	2	-	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P				
B. Tech V Sem.	IPUELT1	Machining and Machine Tool Lab	-	-	2	25	25	50	1

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Operate machine tool equipment commonly found in industry like Lathe, Drilling, Milling, Shaper, planner and slotter machine.
2. Application of utilization of various attachments, jigs and fixtures for different applications.

LIST OF EXPERIMENT:

1. Introduction of Lathe, Drilling, Milling, Shaper, planner and slotter machine.
2. Facing and plain turning on lathe machine.
3. V-groove cutting on shaping machine.
4. Step turning and taper turning on lathe machine.
5. To perform the various milling operation.
6. Thread cutting and knurling on lathe machine.
7. To verify the Merchant's force diagram.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Apply cutting mechanics to metal machining based on cutting force and power consumption.
CO2: Operate lathe, milling machines, drill press, grinding machines, etc.
CO3: Select cutting tool materials and tool geometries for different metals.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	2	2	1	2
CO2	3	2	2	-	-	-	-	-	-	-	-	2	1	2	2
CO3	3	2	1	-	-	-	-	-	-	-	-	2	2	1	2

1: Slight (Low); 2: Moderate (Medium); 3: Substantial (High);

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P				
B. Tech V Sem.	IPUELT2	Modelling and Simulation Lab	-	-	2	25	25	50	1

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

COURSE OBJECTIVES:

The objective of this course is to:

1. Analyzing the force and stress in mechanical components.
2. Analyzing deflection in mechanical components.
3. Analyzing thermal stress of mechanical components.
4. Analyzing heat transfer in mechanical components.
5. Analyzing the vibration of mechanical components.

LIST OF EXPERIMENT (Minimum 10 experiments to be performed):

1. Study of Basics in ANSYS
2. Stress analysis of a plate with a circular hole
3. Stress analysis of rectangular L bracket
4. Stress analysis of cantilever beam
5. Stress analysis of simply supported beam
6. Stress analysis of fixed beam
7. Stress analysis of an axi-symmetric component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component
11. Mode frequency analysis of cantilever beam
12. Mode frequency analysis of simply supported beam
13. Harmonic analysis of a 2D component
14. Stress analysis of a truss
15. Introduction to MAT LAB
16. Simulation of Spring-mass system using MAT LAB
17. Simulation of cam and follower mechanism using MATLAB

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Find out the effect of force and impact of stress on the mechanical components.

CO2: Calculate the deflection occuring on the mechanical components.

CO3: Get a detailed understanding of the thermal stress creation and its mechanism of spreading in mechanical components.

CO4: Gain knowledge regarding the mechanism of heat transfer in mechanical components.

CO5: Find out the vibration effects on mechanical components

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	2	2	1	2
CO2	3	2	2	-	-	-	-	-	-	-	-	2	1	2	2
CO3	3	2	1	-	-	-	-	-	-	-	-	2	2	1	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	2	2	2
CO5	3	2	1	-	-	-	-	-	-	-	-	2	2	1	2

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
NEP–Scheme of Teaching & Examination
W.E.F. Session: 2024-2025
B. TECH. THIRD YEAR, VI SEMESTER

S.N.	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
1.	IPUFTT1	Metrology and Measurement	3	–	–	40	60	100	3
2.	IPUFTT2	Internal Combustion Engine	3	–	–	40	60	100	3
3.	IPUFTT3	Manufacturing Processes -II	3	–	–	40	60	100	3
4.	IPUFTP_	*Professional Elective-1/2*	3	–	–	40	60	100	3
5.	IPUFTP_	*Professional Elective-3/4*	3	–	–	40	60	100	3
6.	_UFTO_	*MOOCs*	3	–	–	40	60	100	3
7.	IPUFTC1	Essence of Indian Traditional Knowledge	3	-	-	-	-	-	-
Total			**18**	–	–	**240**	**360**	**600**	**18**
PRACTICALS									
1.	IPUFLT1	Metrology and Measurement Lab	–	–	2	25	25	50	1
2.	IPUFLT2	Internal Combustion Engine Lab	–	–	2	25	25	50	1
3.	IPUFPF1	Project	–	–	4	50	50	100	2
Total			**–**	**–**	**8**	**100**	**100**	**200**	**4**
GRAND TOTAL			**18**	**-**	**8**	**340**	**460**	**800**	**22**

List of Department/ Program Elective		
S.N.	**Course No.**	**Subject**
1.	IPUFTP1	Product Design and Development
2.	IPUFTP2	Computer Aided Process Planning
3.	IPUFTP3	Supply chain Management
4.	IPUFTP4	Introduction to Robotics

Internal Assessment: – Two class tests of 15 marks each will be conducted. Moreover, 5 marks will be for attendance and 5 marks are allocated for the Assignments, surprise test, quiz test etc.

Approved in BOS meeting held on 28.06.2024

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc.	Attendance			
B. Tech VI Sem.	IPUFTT1	Metrology and Measurement	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To understand, analyze the different measurement systems, Standards of Measurement, Measurement Errors.
2. To know about Limits, Fits, tolerance and gauges used in measurement and designing aspects for those.
3. To familiarize with different types of comparators, optical metrology and their applications.
4. To enlighten students about various techniques of measurement of Screw threads, Gears, Geometric forms and Surface textures.
5. To accustom with various measuring devices for measurement of force, torque, strain, and allied transducers.

COURSE CONTENT:

Module–I

Introduction: Historical development, Basics of Metrology, Need for Inspection, Accuracy and Precision, characteristic of measurement devices, calibration, concept of error, sources of error, analysis of error. standards of measurements, system of measurement, line, end & wavelength standards.

Linear metrology: Steel rule, callipers, Vernier calliper, Vernier height gauge, Vernier depth gauge, micrometres, universal calliper.

Miscellaneous measurements: Taper measurement, angle measurement, radius measurement, sine bar & Angle gauges.

Module–II

Limit Fits and Gauge: Interchangeable manufacture, selective assembly, concept of limits, fits and tolerances, Types of fit, Basic-Hole System, Basic-Shaft System, Problems, Tolerance grades, Metric fits, Indian standard system, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials, Considerations of gauge design, Taylor's principle of gauging.

Module–III

Comparator and Optical gauges: Principle and uses of mechanical, optical, Electrical, electronic and pneumatic Comparators

Principle of interferometer, concept of optical flat, projector, microscope, autocollimator and interferometer

Module–IV

Form measurement: Terminology of screw threads, Measurement of minor, major, thread angle and effective diameter of screw threads by 2-wire and 3- wire methods, best size wire. Screw thread gauges, Tool maker's microscope.

Gear tooth terminology, gear tooth thickness & pitch measurement, involutes profile testing of gear

Straightness, flatness and squareness and circularity tests, numerical evaluation, measurement of surface finish, related instruments.

Automated inspection system, Introduction & applications of Co-ordinate Measuring Machine (CMM)

Module–V

Dynamic measurement: Sensors and Transducers: Types of Sensors, types of transducers and their characteristics

Force and Torque measurement: Direct methods and indirect method, force measuring instruments-load cells, Dynamometer, Power Measurements

Measurement of strain: types of strain gauges, gauge factors, theory of strain gauges and method of measurement.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Distinguish between accuracy and precision, identify different measurement errors, able to select linear or angular measuring instrument for measurement of various components

CO2: Design limit gauges used for various components and purposes.

CO3: Explain principles and uses of comparators and optical instruments used in metrology.

CO4: Examine various screws threads and gears parameter using different methodology and explain capabilities of machining process by measuring surface finish.

CO5: Implement and analyse appropriate measurement methods for variables like force, torque, strain, acceleration and online measurement and micro-nano measurements.

TEXT & REFERENCE BOOKS:

1. Mechanical Measurement - Beckwith and Buch,
2. Instrumentation – R.K. Jain.
3. Automatic Control Engineering–H. Raven.
4. Automatic Process Control - Donal P Eckman.
5. Instrumentation Measurement & Analysis - Nakra & Choudhary.
6. Theory & Application of Automatic Controls – B.C Nakra.
7. Modern Electric Instrumentation -D. Albert Cooper, PHI
8. A Text book of Engineering Metrology, I. C. Gupta, Dhanpat Rai, New Delhi
9. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication (KATSON).
10. Engineering Metrology, M. Mahajan, Dhanpat Rai & Co. New Delhi.
11. Metrology and Measurement, N V Raghavendra and Krishnamurthy, Engineering, Oxford University Press.
12. Metrology and Measurement, Anand Bewoor, VinayKulkarni, McGraw-Hill

Course Outcomes and their mapping with Programme Outcomes and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	2	2	1	-	-	-	1	-	2	3	3	3
CO2	3	-	3	-	1	2	-	-	-	2	-	3	2	3	2
CO3	3	2	2	1	2	2	-	-	-	1	-	2	3	2	3
CO4	3	3	-	2	-	1	-	-	-	-	-	2	3	2	2
CO5	3	-	2	2	3	2	-	-	-	2	-	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Att.			
B. Tech VI Sem.	IPUFTT2	Internal Combustion Engine	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To study classifications of internal combustion engine.
2. To understand how and why actual cycles deviate from air standard cycle and fuel-air cycle.
3. To understand combustion in spark ignition engine and diesel engines.
4. To impart knowledge about carburetion, gasoline injection and diesel injection.
5. To impart knowledge about ignition, cooling, lubrication and governing systems.
6. To impart knowledge about various engine performance characteristics and its testing.

COURSE CONTENT:

Module - I

Introduction of internal combustion engines, classification of I.C. engines, engines components, basic engine nomenclature, four stroke S.I. and C.I. engine, two stroke engines, comparison of two stroke and four stroke engines, comparison of S.I. and C.I. engines, application of IC engines.

Air Standard Cycle: Otto cycle, Diesel cycle, Dual cycle, comparison between Otto, diesel and dual cycles, fuel-air cycles and actual-cycles.

Module - II

Combustion in S.I. Engines: Flame development and its propagation, ignition lag, effect of engine parameters on ignition delay, preignition, knocking in S.I. engines, variables affecting knock, combustion chambers.

Carburettor: Principle of carburetion, elements of carburettor, parameters affecting carburetion, air-fuel mixtures.

Fuel ignition system: Battery and coil ignition system, magneto ignition system, firing order, spark advancing.

Module - III

Combustion in C.I. Engines: Combustion phenomenon in C.I. engines, p-v diagram and their study for various stage of combustion, delay period, detonation in C.I. engines, parameters affecting detonation.

Fuel Injection System: Air and solid injection, fuel pump and injectors.

Module - IV

Engine Friction and Lubrication: Total engine friction, blow by losses, pumping losses, factors effecting engine friction, mechanism of lubrication, lubrication system.

Cooling system: Piston and cylinder temperature distribution, parameters affecting engine heat transfer, principles and various methods of cooling.

Module - V

Supercharging: Effect of altitude on mixture strength and output of SI engines, low and high pressure supercharging, exhaust, gas turbo-charging, supercharging of two stroke engines.

TEXT & REFERENCE BOOKS:

1. A Course in IC Engines - M.L. Mathur and R.P. Sharma, Laxmi Publication.
2. Internal Combustion Engines – V. Ganesan, TMGH Publication.
3. Internal Combustion Engines: Theory and Practice - G.F. Taylor.
4. Introduction to IC Engine - Stone, Richard.
5. Fundamentals of I.C. Engine - Gupta, PHI.

COURSE OUTCOME:

The after completion of the course the student will be able to

CO1: Demonstrate a basic understanding of engine design, function and performance.

CO2: Acquire knowledge and hands-on competence in the design and development of mechanical systems.

CO3: Work effectively with engineering and science teams as well as with multidisciplinary designs.

CO4: Demonstrate an understanding of the relationships between the design of the internal combustion engine and environmental issues.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	**POs**												**PSOs**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	-	-	-	-	-	-	-	2	3	1	2
CO2	3	3	2	2	1	-	-	-	-	-	-	2	2	2	2
CO3	3	2	2	2	1	-	-	-	-	-	-	2	3	1	1
CO4	3	3	2	2	-	-	3	-	-	-	-	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Cred
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc.	Att.			
B. Tech VI Sem.	IPUFTT3	Manufacturing Processes -II	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVE

The main objective of this course is to

1. Understand the concept of stress, deformation and failure, mechanics of metalworking and analysis of different metal working Processes
2. Understand the fundamentals and types of forming processes and able to apply mathematical models in practical metal forming processes used in manufacturing industry.
3. Understand the fundamentals and types of sheet metal operation and its importance in practical engineering applications.
4. Understanding basic principles of powder metallurgy and further being applied by engineers and metallurgists directly contribute towards improvement in production in the industries.
5. Provide conceptual knowledge of Polymers and Composites processing and its importance in real world applications.

COURSE CONTENT:

Module - I

Metal Forming: Stress-strain relations in elastic and plastic deformation; von Mises and Tresca yield criteria, Concept of flow stress; Need and classification, elastic and plastic deformation, yield criteria, fundamentals of hot and cold working processes

Module – II

Introduction, classification and analysis of Bulk deformation process (Rolling, Forging, wire drawing, and Extrusion) and Sheet metal forming process (bending, deep drawing, punching & blanking, coining,

Module - III

Sheet metal working processes – blanking, punching, bending, stretch forming, spinning and deep drawing; Ideal work and slab analysis; Defects in metal working and their causes.

Module - IV

Powder Processing: Production of metal/ceramic powders, Cold and hot isostatic pressing, scope of powder metallurgy, characterization of metal powders, physical properties size and shape determination, technological properties-apparent density, tap density, green density, sintered density, flow rate, post-processing operations etc.

Module -V

Polymers and Composites: Polymer processing – injection, compression and blow molding, extrusion, calendaring and thermoforming, Composites and its Types, Reinforcements and matrices, Properties of composites in comparison with standard materials.

TEXT & REFERENCE BOOKS:

1. Rao P.N., "Manufacturing Technology", (Vol. 2), Tata McGraw-Hill, 1998.
2. A Ghosh and A K Mallik, Manufacturing Science, Wiley Eastern, 1986.
3. Lindberg R.A., "Processes and Materials of Manufacture", Prentice-Hall of India, 1990.
4. Groover M.P., "Fundamentals of Modern Manufacturing", John Wiley & Sons 2002.
5. Kalpakjian S., and Schmid S.R., "Manufacturing Engineering and Technology", Pearson Education, 2000.
6. DeGarmo E.P., Black J.T., and Kohser R.A., "Materials and Processes in Manufacturing", Prentice-Hall of India, 1997.
7. R.M. German, Powder Metallurgy Science, 2008.
8. 6. A. Upadhyaya, G.S. Upadhyaya, Powder Muetallurgy: Science Technology and Materials, 2011
9. 7. Dieter George E., Mechanical Metallurgy, McGrawHill

COURSE OUTCOMES

After completing the course students will be able to:

CO1: To understand and apply the mechanism of deformation for different metal forming processes

CO2: To determine forming process controlling parameters and analyze the behaviour of materials during forming processes

CO3: To determine the causes of the defects that may take place during forming processes and to integrate knowledge gained in this course to select and design a complete metal forming system.

CO4: Student will able to understand the powder processing techniques and scope of powder metallurgy in real world applications

CO5: Student will able to understand Polymers and Composites and its processing for different engineering applications

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3	-	-	-	-	-	-	-	2	2	1	2
CO2	3	2	2	2	-	-	-	-	-	-	-	2	2	2	2
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	1	1
CO4	2	2	2	2	-	-	3	-	-	-	-	2	2	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VI Sem.	IPUFTP1	Product Design and Development	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

The objectives of this course are:

1. To introduce design concepts and techniques to develop design ability in a product design.
2. To provide knowledge about estimating and evaluating the feasible manufacturing design.
3. To make aware of legal issues pertaining to product design.
4. To provide knowledge of management of product development projects.

COURSE CONTENT:

MODULE – I

Product design: Definition, design by evolution, innovation, essential factors of product design, production-consumption cycle, flow and value addition in the production-consumption cycle, the morphology of design, primary design phases and flow charting, role of allowance, concurrent engineering.

MODULE – II

Product design practice and industry: Introduction, product strategies, time to market, analysis of the product, three S's, standardization, Renard series, simplification.

Designer: Role, myth and reality, industrial design organization, basic design considerations.

MODULE – III

New products idea generation: Modification, product variants: adding, dropping, formal testing: new products, concept, product testing, market tests, evaluation, adoption, expansion and forecasting.

Economic factors influencing design: Product value, economic analysis, profit and competitiveness.

Product design for environment: Introduction, importance of DfE, environmental factors, scope of environmental impact, design guidelines for DfE.

MODULE – IV

Developing product strategy: Benefits of strategy, elements of a product strategy, setting objectives, selection of strategic alternatives, increasing sales/market share, increasing profitability, design for manufacturing and design for assembly, ergonomics in design, modular versus integral design.

Human engineering considerations in product design: Introduction, anthropometry, design of controls, the design of displays, man/machine information exchange.

MODULE -V

Intellectual property systems: Definition, concept of intellectual property, kinds of intellectual property, economic importance of intellectual property, importance of IPR, TRIPS and its implications.

Trademark: Introduction, historical development of the concept, need for protection, kinds of trademarks, and well-known trademarks, patents: historical development, concepts, novelty, utility, inventiveness/non-obviousness, copyrights, industrial design.

TEXT & REFERENCE BOOKS:

1. Product Design and Manufacturing, A. K. Chitale & R. C. Gupta, PHI.
2. Fundamentals of Design and manufacturing, V. Gupta, G.K. Lal & Reddy, Narosa Publishing.
3. Design and technology (1996), James Garratt, Cambridge University Press.
4. Product Management, Donald R. Lehman, S. Rusell Wines, 3rd Edition, TMH.
5. Product Life Cycle Engineering and Management, CEP Lecture notes, Prof B. Ravi, IIT Bombay.
6. Product Design & Development, Karl. T. Ulrich & Steven D. Eppinger, 3rd addition, TMH.

COURSE OUTCOMES:

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

1. Describe an engineering design and development process.
2. Identify, formulate, and solve engineering problems.
3. Design a system, component, or process to meet desired needs.
4. Understand the professional and ethical responsibility.
5. Recognize the legal issue pertaining to patents of product design.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	1	-	-	2	3	1	1	1	2	2	2
CO2	3	2	2	1	1	-	-	2	2	2	2	2	3	2	2
CO3	3	2	2	2	1	2	3	2	2	2	2	2	2	3	2
CO4	1	2	2	-	1	2	2	2	2	2	1	1	1	1	1
CO5	1	-	1	2	-	1	1	2	2	2	1	1	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc.	Attendance			
B. Tech VI Sem.	IPUFTP2	Computer Aided Process Planning	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

The objective of this Course is to:

- Learn the fundamentals of computer aided process planning, group technology and applications.
- Study the simulation of machining processes, importance of design and manufacturing tolerances.
- Understand the role of optimal selection of machining parameters.

COURSE CONTENT:

MODULE -I

Introduction to CAPP: Information requirement for process planning system, role of process planning, advantages of conventional process planning over CAPP, structure of automated process planning system, feature recognition, methods.

MODULE – II

Generative CAPP system: Importance, principle of generative CAPP system, automation of logical decisions, knowledge-based systems, inference engine, implementation, benefits.

Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications.

MODULE –III

Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence, quantitative methods for optimal selection, examples.

MODULE – IV

Determination of machining parameters: Reasons for optimal selection of machining parameters, effect of parameters on production rate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

MODULE – V

Generation of tool path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods.

TEXT & REFERENCE BOOKS:

1. Automation, Production systems & Computer Integrated Manufacturing System, Mikell P. Groover, PHI Publication.
2. Computer Aided Engineering, David Bedworth, TMH Publishers
3. Computer Aided Design and Manufacturing, Sadhu Singh, Khanna Publisher.
4. Computer Aided Process Planning, H.P. Wang and J.K. Li, Elsevier Science and Technology Publishers, 1st edition, 1991.
5. Computer Aided Process Planning, Joseph Tulkoff, SME Publications.

COURSE OUTCOMES:

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

- Generate the structure of automated process planning system and uses the principle of generative and retrieval CAPP systems for automation.
- Select the manufacturing sequence and explains the reduction of total set up cost for a particular sequence.
- Predict the effect of machining parameters on production rate, cost and surface quality and determines the manufacturing tolerances.
- Explain the generation of tool path and solve optimization models of machining processes.
- Create awareness about the implementation techniques for CAPP.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	-	2	1	2
CO2	3	2	2	2	1	-	-	-	-	1	-	-	2	2	2
CO3	3	1	3	1	2	-	-	-	-	-	-	-	2	1	2
CO4	3	2	3	1	2	-	-	-	-	-	-	-	2	1	2
CO5	3	2	1	1	2	-	-	-	1	-	3	-	2	1	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc.	Attendance			
B. Tech VI Sem.	IPUFTP3	Supply Chain Management	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

The objective of this Course is to:

- To understand supply chain activities, process planning, decision phases, importance and management of supply chains.
- To examine various drivers of supply chain for acquiring effectual performance, ease distribution and acquisition of production resources & Inventories.
- To understand about uncertainty, risk management, distribution network, role of location, capacity and forecasting in SC.
- To adapt drivers of supply chain, related framework and to appraise supply chain performance, pricing and sourcing decisions.

COURSE CONTENT:

MODULE -I

Building a strategic framework to analyze supply chains: Supply chain, its objective and the importance of supply chain decisions, decision phases in a supply chain, process view of a supply chain, examples of supply chains, supply chain performance, achieving strategic fit and scope, competitive and supply chain strategies, achieving strategic fit, expanding strategic scope, supply chain drivers and metrics, drivers of supply chain performance, frame work for structuring drivers, facilities, inventory, transportation, information, sourcing, pricing.

MODULE -II

Designing the supply chain network: Designing distribution networks and applications to e-business the role of distribution in the supply chain, factors influencing distribution network design, design options for a distribution network, e-business and the distribution network, distribution networks in practice.

Network design in the supply chain: The role of network design in the supply chain, factors influencing network design decisions framework for network design decisions, models for facility location and capacity allocation, role of IT in network design, making network design decisions in practices

MODULE -III

Demand forecasting in a supply chain- the role of forecasting in a supply chain, characteristics of forecasts, components of a forecast and forecasting methods, basic approach to demand forecasting, time-series forecasting methods, measures of forecast error, forecasting demand at Tahoe salt, role of IT in forecasting, risk management in forecasting, forecasting in practice.

Aggregate planning in a supply chain: Role of aggregate planning in a supply chain, the aggregate planning problem, aggregate planning strategies, aggregate planning using linear programming, aggregate planning in excel, role of IT in aggregate planning, implementing aggregate planning in practice.

MODULE –IV

Planning supply and demand in a supply chain: Managing predictable variability**,** responding to predictable variability in a supply chain, managing supply, managing demand, implementing solutions to predictable variability in practice.

Planning and managing inventories in a supply chain: Managing economies of scale in a supply chain, cycle inventory, the role of cycle inventory in a supply chain, economies of scale to exploit fixed costs, economies of scale to exploit quantity discounts, short-term discounting, trade promotions, managing multi-echelon cycle inventory, estimating cycle inventory-related costs in practice.

MODULE –V

Managing uncertainty in a supply chain: Safety inventory**,** the role of safety inventory in a supply chain, determining appropriate level of safety inventory, impact of supply uncertainty on safety inventory, impact of aggregation on safety inventory, impact of replenishment policies on safety inventory, managing safety, inventory in a multi-echelon supply chain, role of IT in inventory management, estimating and managing safety inventory in practice.

Determining the optimal level of product availability: The importance of the level of product availability, factors affecting optimal level of product availability. managerial levers to improve supply chain profitability, setting product availability for multiple products under capacity constraints, setting optimal levels of product, availability in practice.

TEXT & REFERENCE BOOKS:

1. Supply Chain Management, Janat Shah, 2010, Pearson Publications.
2. Supply Chain Management, Sunil Chopra & Mein del, Fourth Edition, 2010, PHI.
3. Supply Chain Management, A.S. Altekar, Second Edition, 2006, PHI.
4. Logistics Management, James Stock & Douglas Lambert, Edition,2006, McGrawHill International.
5. Supply Chain Management for Global Competitiveness, B.S.Sahay, 2000,McMillan Publication.
6. Emerging Trends in Supply Chain Management, B.S. Sahay 2000, McMillan Publication.
7. Logistics Management, Bowersox, 2004, TMH.

COURSE OUTCOMES

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

- Demonstrate basic understanding about competition, logistics network, capable factors for supply chain designs and supply chain strategies.
- Acquire knowledge about distribution network, e-business, forecasting, network design and time- series analysis.
- Decide technical understanding about demand, inventory, safety, pricing and information technology
- Manage and measure sourcing decisions in supply chain, product availability under capacity constraints, optimal levels of product, services and resources.

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	2	1	2	-	-	-	2	1	1	2
CO2	1	3	3	2	2	1	2	2	-	-	-	2	2	2	2
CO3	2	2	3	3	2	2	2	2	-	-	-	3	2	2	2
CO4	3	3	2	2	2	2	3	2	-	-	-	2	2	2	2

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc.	Attendance			
B. Tech VI Sem.	IPUFTP4	Introduction to Robotics	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

The objective of this course is to:

1. To define basic concept about robots, robotics and programming.
2. To learn about coordinate frames, mapping and transforms plots.
3. To understand kinematic modelling of the manipulators and their working.

COURSE CONTENT:

MODULE -I

Introduction to robotics: Evolution of robots and robotics, progressive advancement in robots, definitions and classifications, laws of robotics, robot anatomy and related attributes, repeatability, accuracy and precision, human arm characteristics, robot specification and notations, concept of robots programming, the future prospects.

MODULE – II

Coordinate frames, mapping and transforms: Coordinate frames, spatial descriptions and transformations, fundamental of translation, rotations and transformations, inverting a homogeneous transform, fundamental rotation matrices, yaw pitch and roll, yaw pitch and roll transformation, equivalent angle.

MODULE – III

Symbolic modeling of robots, direct kinematic model: Mechanical structure and notations, description of links and joints, kinematic modeling of the manipulator, Denavit-Hartenberg (D- H) representation, kinematic relationship between adjacent links, manipulator, transformation matrix, arm equations.

MODULE – IV

Robotic sensors and vision: The meaning of sensing, sensors in robotics, kinds of sensors used in robotics, robotic vision, industrial applications of vision-controlled robotic systems, process of imaging, architecture of

robotic vision systems, image acquisition, description of other components of vision system, image representation, image processing, artificial intelligence (AI) in robotics.

MODULE – V

Robot controller & applications: Linear control of robot manipulation, feedback and close loop control, second-order linear systems, trajectory following control, modelling and control of single joint, architecture of industrial robotic controllers, artificial intelligence, industrial and non-industrial applications, robotic application for sustainable development & social issues.

TEXT & REFERENCE BOOKS:

1. Robotics & Control, R.K. Mittal & I.J. Nagrath, TMH Publications
2. Introduction to Robotics - S S.K. aha – McGrew Hill Co.
3. Robotics for engineers, Yoram Korean, McGrew Hill Co.
4. Industrial Robotics Technology programming and Applications, M.P. Groover, M. Weiss.
5. Robotics Control Sensing, Vision and Intelligence - K.S. Fu, R.C. Gonzalex, C.S.G. Lee, McGrew Hill Book Co.
6. Kinematics and Synthesis of linkages, Hartenberg & Denavit, McGrew Hill Book Co.

COURSE OUTCOMES:

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

1. Apply knowledge of robotics for understanding, formulating and solving engineering problems.
2. Demonstrate creativeness in designing and development of robotics.
3. Analyse the kinematic of industrial robot.
4. Design control laws for a simple robot.
5. Identify, analyse and design of robots useful to the society.

Course Outcomes and their mapping with Programme Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	-	-	-	-	3	1	2
CO2	3	3	3	2	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	-	2	3	2
CO4	3	2	2	2	2	-	2	-	-	-	-	-	3	2	2
CO5	3	2	3	2	2	3	-	-	-	-	1	-	2	2	3

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credi
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc.	Attendance			
B. Tech VI Sem.	IPUFTC1	Essence of Indian Traditional Knowledge	3	-	-	-	-	-	-	-	-	-

COURSE OBJECTIVES:

- The course aims at imparting basic principles of thought process, reasoning and inferencing. sustainability is at the core of Indian traditional knowledge systems connecting society and nature.
- Holistic life style of yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian knowledge system, Indian perspective of modern scientific world-view and basic principles of yoga and holistic health care system.

COURSE CONTENT:

- Basic structure of Indian knowledge system: अष्टादशविद्या ,४वेद, ४उपवेद; आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि, ६वेदांग, शिक्षा, कल्प, निरुक्त, ज्योतिष, छंद, ४ उपाङ्ग, धर्मशास्त्र मीमांसा पुराण तर्कशास्त्र
- Modern science and Indian knowledge system.
- Yoga and holistic health care.
- Case studies.

TEXT & REFERENCE BOOKS:

1. Cultural Heritage of India-course material, V. Sivaramakrishnan (Ed.), Bharatiya Vidya Bhavan, Mumbai 5th Edition, 2014.
2. Modern Physics and Vedant, Swami Jitatmanand, Bharatiya Vidya Bhavan.
3. Tao of Physics, Fritz of Capra.
4. Tarkasangraha of Annam Bhatta, V.N. Jha (Eng. Trans.), International Chinmay Foundation, Velliarnad, Arnakulam.
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
6. Yoga-darshanam with Vyasa Bhashya, G.N. Jha (Eng. Trans.), Ed. R.N. Jha, Vidyanidhi Prakashan, Delhi 2016.

COURSE OUTCOMES:

- Ability to understand, connect up and explain basics of Indian traditional knowledge modern scientific perspective.

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
B. Tech VI Sem.	IPUFLT1	Metrology and Measurement Lab	-	-	2	25	25	50	1

COURSE OBJECTIVES:

1. Identify and classify different measuring tools related to experiments.
2. Identify, define and explain accuracy, precision and some additional terminology.
3. Conduct, analyze, interpret and present measurement data from measurements experiments.
4. Identify sources of variability, error and uncertainties.
5. Demonstrate excellent laboratory skills and techniques including the proper use of relevant instruments and related technology.
6. Enhance the ability to apply knowledge of mathematics, statics, physics and engineering sciences.

LIST OF EXPERIMENT (Minimum 10 experiments to be performed):

1. To measure pressure using Bourdon pressure gauge.
2. To calibrate pressure gauge using Dead weight pressure gauge tester.
3. To measure temperature using thermister.
4. To measure flow rate using Rota meter.
5. To measure angle using Angular sensor.
6. To measure torque using Torque transducer.
7. To measure pressure using pressure transducer.
8. To measure temperature by thermocouple.
9. Measurements of lengths, heights, diameter by Vernier Calipers, Vernier height gauge, Micrometers.
10. Measurement of various angles using Bevel protractor, Sine bar & Combination set.
11. Calibration of Vernier caliper, Micrometer, Height gauge, Depth micrometer using slip.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc).

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	-	-	2	-	2	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
B. Tech VI Sem	IPUFLT2	Internal Combustion Engine Lab	-	-	2	25	25	50	1

COURSE OBJECTIVES

1. To understand about the components & combustion phenomenon of SI and CI engines.
2. To understand cooling, lubrication & Carburation systems in engines.
3. To Evaluate the performance parameters of IC engines.

LIST OF EXPERIMENTS

1. To Study about Ignition System of SI Engine
2. To Study of Carburetion system in SI Engine
3. Jo Study about working of Single Cylinder 4 Stroke Petrol Engine with Test Rig Jo Study about Working Model of Lubricating System
4. To Study Single Cylinder 4 Stroke Diesel Engine Test Rig with Dynamometer
5. Jo Study about 4 stroke diesel Engine Components with Cut Section model To Study about 4 stroke petrol engine with Cut Section model
6. Jo Study about 2 stroke petrol engine with Cut Section model
7. Study about working of 4 Stroke Diesel Engine with Test Rig

COURSE OUTCOME

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

1. Demonstrate the components & combustion phenomenon of SI and CI engines
2. Understand cooling & lubrication systems in engines
3. Calculate performance parameters of SI engines.
4. Evaluate the performance parameters of CI engines

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	2	-	2	2	1	2	1
CO2	2	2	1		-	-	-	-	-	-	-	-	2	1	1
CO3	1	2	1		-	-	-	-	-	-	-	-	1	1	1
CO4	2	2	1		-	-	-	-	-	-	-	-	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
NEP 2020–Scheme of Teaching & Examination
W.E.F. Session: 2025-2026
B. TECH FOURTH YEAR, VII SEMESTER

S.N.	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
1.	IPUGTT1	Production Planning and Control	3	–	–	40	60	100	3
2.	IPUGTT2	Computer Integrated Manufacturing	3	–	–	40	60	100	3
3.	IPUGTP_	*Professional Elective-1/2/3*	3	–	–	40	60	100	3
4.	IPUGTP	*Professional Elective-4/5/6*	3	–	–	40	60	100	3
5.	IPUGTP_	*Professional Elective-7/8/9*	3	–	–	40	60	100	3
6.	_UGTO_	*MOOCs*	3	–	–	40	60	100	3
Total			**18**	–	–	**240**	**360**	**600**	**18**
PRACTICALS									
1.	IPUGLT1	Computer Integrated Manufacturing Lab	–	–	2	25	25	50	1
2.	IPUGPF1	Minor Project	–	–	8	50	50	100	4
3.	IPUGSL1	Industrial Training Seminar	–	–	–	–	–	–	–
Total			**–**	**–**	**10**	**75**	**75**	**150**	**5**
GRAND TOTAL			**18**	**-**	**10**	**315**	**435**	**750**	**23**

List of Department/ Professional Elective		
S.N.	**Course No.**	**Subject**
1.	IPUGTP1	Intellectual Property Rights
2.	IPUGTP2	Marketing Management
3.	IPUGTP3	Engineering Economics
4.	IPUGTP4	Fundamentals of Green Manufacturing
5.	IPUGTP5	Quality & Maintenance Management
6.	IPUGTP6	Power Plant Engineering
7.	IPUGTP7	Advanced Manufacturing Processes
8.	IPUGTP8	Turbo machinery
9.	IPUGTP9	Heat & Mass Transfer

Internal Assessment: – Two class tests of 15 marks each will be conducted. Moreover, 5 marks will be for attendance and 5 marks are allocated for the Assignments, surprise test, quiz test etc.

Approved in BOS meeting held on 28.06.2024

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc.	Attendance			
B. Tech VII Sem.	IPUGTT1	Production Planning and Control	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES

1. To originate engineering skills to identify, formulate, and solve industrial process problems.
2. To demonstrate the concept of organization, production systems and cost analysis.
3. To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
4. To develop an ability to apply PPC concepts in a various area like marketing, accounting, finance, engineering, personnel management, logistics, etc.
5. To integrate operations concepts with other functional areas of business and to compile several important contemporary topics relevant to business managers under functional disciplines, including quality management, production concepts, and sustainability issues.
6. To evaluate the PPC function in both manufacturing and service organizations and to examine several dilemmas related to operations management, production planning and inventory control.

COURSE CONTENT

Module – I

Introduction: Introduction to various types of production system viz. mass production, job shop, batch production system, continuous production system, concept of production and operation management, objective & functions of PPC.

Forecasting: Time series method, moving average, exponential smoothing, weighted average, trend, seasonality, regression technique, delphi method, hands on training software – R and Python.

Module – II

Aggregate planning: Definition, strategies, pure and mixed strategies, methods.

Master production schedule: Objective and functions, design of MPS, bill of materials.

Material requirement planning: Objectives, functions, MRP, MRP-II, ERP, limitations.

Capacity requirement planning: Definition, objectives, process of CRP, process sheet, rough cut capacity planning, loading, and preparation of CRP chart, Logistics, distribution, and supply chain management.

Inventory: functions, costs, classifications, deterministic inventory models, quantity discount; Perpetual and periodic inventory control systems.

Module – III

Scheduling: Types, single machine scheduling, job shop scheduling, flow scheduling; routing, priority dispatching, hands on training software – OpenSolver (Excel Add-In) and COIN-OR.

Sequencing: Various priority rules, line of balancing, rank and positional weight method, Kilbridge westner method.

Facility location and facility location problems: Factors affecting plant locations, single facility locations problems and its methods.

Module – IV

Types of layouts: layouts design procedure such as CORELAP, CRAFT etc., material handling system & their classification, principles, push and pull production systems, Lean, JIT & KANBAN, depreciation & methods of depreciation.

Module -V

Maintenance management: Types of maintenance strategies, breakdown and preventive maintenance, predictive and total productive maintenance, condition monitoring, individual and group replacement policies, make or buy decision, concept of original equipment effectiveness.

Engineering Economy and Costing: Elementary cost accounting and methods of depreciation; Break-even analysis; Techniques for evaluation of capital investments; Financial statements; Activity based costing, hands on training software – COIN-OR and Python.

TEXT & REFERENCE BOOKS

1. Production and operation management, O. Paneerselvem, TMH.
2. Production and operation management, Adem Ebert.
3. Production and operation management, Charry S.N. TMH.
4. Production and operations management Theory and practice Mahadevan. B.
5. Production and operation management, Joseph G. Monks, TMH.
6. Handbook of Material Handling, Ellis Horwood limited.
7. Operations Management: Design Planning and control for the manufacturing and services.
8. Lawrence P. Atkin, James B. Dilworth Tata Mc Graw Hill.
9. Production and Operations management, R.B Khanna, PHI.
10. Production operations management, S.N. Buffa, PHI

COURSE OUTCOMES

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

CO1: Recognize the objectives, functions and applications of Production management and allied techniques.
CO2: Categorize and solve different inventory control techniques, forecasting dilemmas, routing problems and scheduling troubles.
CO3: Summarize various aggregate production planning techniques and integrating them to different departments to execute effective PPC functions.
CO4: Inspect organizational performance, production systems, demand trends, location feasibility and cost analysis.
CO5: Elaborate and estimate methods of line balancing, process sheets, production strategies, sales forecasting and maintenance.

Course Outcomes and their mapping with Programme Outcomes and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	2	1	-	-			2	-	3	2	2	2
CO2	3	3	2	3	2	-	-	1		2	3	2	3	3	3
CO3	3	3	2	3	2	-	-	2		2	3	3	3	2	3
CO4	3	2	3	2	2	2	-		2	2	-	2	3	3	3
CO5	3	3	2	1	3	2	-			2	-	3	2	3	3

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem.	IPUGTT2	Computer Integrated Manufacturing	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

The objective of this course is to:

- Provide the basics of computer aided design.
- Familiarize the student about various geometric modelling and transformations.
- To understand the concept of NC Part Programming for various machining processes.
- To study Basic features NC and CNC for advanced design and manufacturing.
- Integrate the CAD system and the CAM system by using advanced manufacturing methods.

COURSE CONTENT:

MODULE-I

Basics of CAD: Basics of Computer Aided Design, Introduction to Computer graphics, DDA and Bresenham's algorithm for generating various figures, and basics of CAD/CAM hardware

MODULE - II

Geometric modeling of curves, Basics representation of curves, parametric and non- parametric curves, mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves basic concept of solid modeling technique, CSG and B-rep method for solid generation.

Geometric transformation: 2D and 3D geometric transformation, homogeneous transformation, concatenation, concurrent engineering.

MODULE – III

Part Programming: Introduction to NC part programming, manual part programming, computer assisted part programming, automatically programming tool (APT) language, G & M codes for NC part programming, advantages of CAD/CAM programming

MODULE – IV

Basics of CAM: Need of NC technology, Fundamental concepts in numeric control: structure and functions of NC System, advantages of NC technology over conventional manufacturing. Application of NC, concepts of computer numeric control (CNC) system, problems with conventional, NC, CNC.

.

MODULE - V

Computer Integrated Manufacturing: Concept of distributed numeric control (DNC) system, Industrial Robots – configurations, drives and controls, Flexible manufacturing system (FMS), Cellular manufacturing and FMS - Group Technology, CAPP.

TEXT & REFERENCE BOOKS:

1. Principles of Computer Graphics, W. M. Neumann and R.F. Sproul, McGraw Hill.
2. Computer Graphics, D. Hearn and M.P. Baker, Prentice Hall Inc.
3. CAD/CAD Theory & Practice, I. Zeid & R. Sivasubramanium, TMH.
4. CAD/CAM, Groover & Zimmer, Prentice Hall, India.
5. Computer Graphics & CAD, Ramamurthy, T.M.H.
6. Industrial Robotics & CIM, Surendra Kumar I.B.H.
7. CAD/CAM, P.N. Rao, Prentice Hall, India.
8. Mastering CAD CAM, Ibrahim Zeid, Tata McGraw Hill Publishing Co.
9. CAD/CAM Principles, C. McMohan & J. Browne, Pearson Education.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Understand the fundamental of CAD Graphic standards and their modes
- Gain an understanding of geometric modelling and geometric transformation concepts.
- Analyse the NC programs to generate and verify the tool path using G and M Code for milling and drilling manufacturing processes.
- Explain fundamental and advanced features of NC and CNC machines.
- Understand and apply advanced concepts in CIM, including DNC, industrial robot, FMS, GT and Computer-Aided Process Planning (CAPP).

Course Outcomes and their mapping with Programme Outcomes and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	-	2	2	3	1
CO2	3	3	2	1	2	-	-	-	-	-	-	2	3	3	1
CO3	3	2	1	2	2	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
CO5	3	2	1	2	2	-	-	-	-	-	-	2	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc.	Attendance			
B. Tech VII Sem.	IPUGTP1	Intellectual Property Rights	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Understand, define and differentiate various types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
- Understand the framework of strategic management of Intellectual Property (IP).
- Appreciate and appraise different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs.
- Explain how to derive value from IP and leverage its value in new product and service development.

COURSE CONTENT:

MODULE - I

Introduction to intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

MODULE - II

Trademarks: Purpose and function of trademarks, acquisition of trademarks rights, protectable matter, selecting and evaluating trademark, trademark registration processes.

MODULE - III

Law of copyrights and law of patents: Fundamentals of copyrights law, originality of material, rights to reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright law, foundation of patent law, patent searching process, ownership rights and transfer.

MODULE - IV

Trade secrets and unfair competition: Trade secrets law, determination of trade secrets status, liability for misappropriations of trade secrets, protection for submission, trade secrets litigation, misappropriation of right

of publicity and false advertising.

MODULE - V

New developments of intellectual property: New developments in trade law, copyright law, patent law, intellectual property audits international overview of intellectual property, international-trademark law, copyright law, international patent law, international development in trade secrets law.

TEXT & REFERENCE BOOKS:

1. Intellectual Property Right, Deborah. E. Bouchoux, 4th Edition, 2013, Cengage Learning.
2. Intellectual Property Right: Unleashing the Knowledge Economy, Prabuddha Ganguli, 3 rd Edition, 2005, Tata McGraw Hill Publishing Company Ltd.

COURSE OUTCOMES:

At the end of the course the students will be able to:

- Identify the different types of Intellectual properties (IPs), the right of ownership and scope of protection.
- Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
- Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
- Analyze ethical and professional issues which arise in the intellectual property right context.
- Apply intellectual property right principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual property rights.
-

Course Outcomes and their mapping with Programme Outcomes and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	3	3	1	2	1	3	2	3	2	2	2	2	2
CO2	-	2	3	3	1	1	1	3	3	2	3	2	3	2	3
CO3	-	3	3	2	1	2	2	3	2	3	3	2	2	3	1
CO4	-	2	3	3	2	2	1	3	2	3	2	2	3	2	2
CO5	-	2	3	3	1	1	2	3	3	2	2	1	3	2	2

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem.	IPUGTP2	Marketing Management	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Explain about basic concepts of marketing and selling.
2. Demonstrate importance of need, wants and demand.
3. Analyze implicating strategies in different phases of product lifecycle.
4. Discuss in detail about the marketing program.

COURSE CONTENT:

Module – I

Introduction to marketing management: What is marketing, the core concept, need, wants, demands, product, value cost and its functions.

Marketing management: Production concept, product concept and selling, marketing concept, role of marketing in modern organization, marketing philosophies.

Module – II

The nature of high-performance business: Corporate and division strategic planning, business strategic planning, marketing process, analyzing consumer markets and buying behaviour.

Module – III

The product life cycle: Conditions and strategies in different phases, marketing strategies through PLC.

New product decisions: Definitions and factors contributing to new production development, new product development process.

Module – IV

Deciding on the marketing program: Product, promotion, pricing, place (distribution channel), managing advertising, sales promotion, public relation, developing and managing development program, sales promotion and public relation.

Module – V

Managing retailing whole selling and logistic: Types of retailers and levels of services, trends in retailing, types of whole selling, market logistics.

The role of marketing communication: Communication process model and developing effective e-communication, characteristics of marketing communication mix, factors in setting the communication mix.

TEXT & REFERENCE BOOKS:

1. Product Design and Manufacturing, Chitale & Gupta, PHI.
2. Marketing Management, Philip Kotler, PHI Publication.
3. Suja Nair, Retail Management, Mumbai: Himalaya Publishing House.
4. Fred N Kerlinger, Foundations of Behavioural Research, New Delhi: Surjeet Publication.
5. Judith W. Kincaid, Customer Relationship Management: Getting It Right, New Jersey: Prentice Hall, New Delhi

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1- Understand the concepts such as basics of marketing and selling.

CO2-Analyze high performance business ethics and culture in marketing and buying behaviour.

CO3 - Identify the concept of product life cycle and new product decision.

CO4-Apply the knowledge of the distribution channel, sales promotion and public relation.

CO5 -Demonstrate the importance of retailing, whole selling and marketing logistics.

Mapping of Course Outcomes (CO) onto Program Outcomes (PO) and Program Specific Outcomes (PSO):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	2	1	-	-	-	-	-	-	-	-	2	-	-
CO3	3	1	2	1	-	-	-	-	-	-	-	-	3	-	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	1	1
CO5	3	1	-	-	-	-	-	-	-	-	-	-	2	1	1

Weightage: 1-Sightly; 2-Moderately; 3-Strongly

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem.	IPUGTP3	Engineering Economics	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- Prepare students to analyse cost/revenue data and carry out economic analyses in the decision-making process to justify or reject alternatives/projects on an economic basis.

COURSE CONTENT:

MODULE - I

Basic concepts and definitions: Methodology of economics, demand and supply-elasticity, theory of the firm and market structure, price and output determinations in different types of market.

MODULE - II

Public sector economics: Welfare economics, central and commercial marks and their functions, industrial policies, theory of localization, weber & surgent florence theory, investment analysis - NPV, ROI, IRR, payback period, SWOT analysis.

MODULE - III

Monetary and fiscal policy: Tools, impact on the economy, inflation, business cycle, cash flow-2, 3, 4 model.

MODULE - IV

Business forecasting: Elementary techniques, cost and revenue analysis, capital budget, break even analysis.

MODULE - V

Indian economy: Urbanization, unemployment–poverty, regional disparities, unorganized sectors roll of plans, reforms-post independent period.

TEXT & REFERENCE BOOKS:

1. Principles of Economics, N. Mankiw Gregory (2002), Thompson Asia.
2. Managerial Economics, V. Mote, S. Paul, G. Gupta (2004), Tata McGraw Hill.

3. Indian Economy, Its Development Experience Misra, S. K. and Puri V. K., Himalaya Publishing House, Mumbai.
4. Textbook of Business Economics, Pareek Saroj (2003), Sunrise Publishers.
5. Indian economy since Independence, U. Kapila, Academic Foundation, New Delhi.
6. Indian Economy, R. Dutt & K.P.M. Sundharam, S. Chand & Company Ltd., New Delhi.
7. Indian Economic Policy and Reform, R. Mathur, RBSA Publisher, Jaipur.
8. Indian Economic Policy, B. Jalan, Penguin Books Ltd.
9. Economic Survey (Annual), Government of India, Economic Division, Ministry of Finance, New Delhi.

COURSE OUTCOMES:

At the end of the course, the students will be able to:

- Describe the role of economics in the decision-making process and perform calculations in regard to interest formulas.
- Trained towards estimating the present, annual and future worth comparisons for cash flows.
- Calculate the rate of return, depreciation charges and income taxes.
- Enumerate different cost entities in estimation and costing the elements of budgeting.
- Explain the importance of finance functions, financial ratios and solve related problems.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	-	-	-	-	-	2	2	-	-	-	2	3	3	2	3
CO2	-	-	-	-	-	3	2	2	-	-	2	1	3	2	2
CO3	-	-	-	-	-	2	3	-	-	-	2	2	2	3	-
CO4	-	-	-	-	-	2	2	1	1	-	3	1	3	2	-
CO5	-	-	-	-	-	1	2	1	2	1	3	1	2	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem.	IPUGTP4	Fundamentals of Green Manufacturing	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To originate engineering skills to identify, formulate, and solve industrial process problems.
- To demonstrate the concept of organization, production systems and cost analysis.
- To understand the problems and opportunities faced by the operations manager in manufacturing and service organizations.
- To develop an ability to apply PPC concepts in various areas like marketing, accounting, finance, engineering, personnel management, logistics, etc.
- To integrate operations concepts with other functional areas of business and to compile several important contemporary topics relevant to business managers under functional disciplines, including quality management, production concepts, and sustainability issues.
- To evaluate the PPC function in both manufacturing and service organizations and to examine several dilemmas related to operations management, production planning and inventory control.

COURSE CONTENT:

MODULE-I

Introduction: Sustainable development, indicators of sustainability, sustainability strategies, sustainable manufacturing, evolution of sustainable manufacturing, elements of sustainable manufacturing, theory of green manufacturing and its principles, need for green manufacturing, drivers and barriers of green manufacturing.

MODULE - II

Green manufacturing strategy: Manufacturing strategy, elements of manufacturing strategy, manufacturing out puts, competitive priorities: quality, delivery speed and reliability, cost efficiency, flexibility, order winners and order qualifier, tradeoff, production systems, manufacturing levers, competitive analysis, level of manufacturing

capability, framework for formulating manufacturing strategy, implications of green manufacturing for manufacturing strategy.

MODULE – III

Life cycle approach of green manufacturing: Holistic and total Life-cycle approach, six step methodologies for green manufacturing (6-R approach), life cycle assessment (LCA), elements of LCA, life cycle costing, eco labelling target setting, data collection and processing, final evaluation by virtue of criteria, environmental management systems.

MODULE – IV

Green manufacturing technology: Definition of green manufacturing technology and practices, classifications of green manufacturing technology, advantages and disadvantages of implementation of green technology.

MODULE – V

Lean and Green manufacturing: Introduction, lean evolution & steps, introduction to lean manufacturing, definition of lean manufacturing, lean vs. green manufacturing: similarities and differences.

TEXT & REFERENCE BOOKS:

1. Cleaner Production: Environmental and Economic Perspectives, Misra Krishna B., Springer, Berlin, Latest edition.
2. Environmental Management Systems and Cleaner Production, Dr. Ruth Hillary, Wiley, New York, Latest edition.
3. Pollution Prevention: Fundamentals and Practice, Paul L Bishop, TMH.
4. Costing the earth, Cairncrss and Francis, Harvard Business School Press – 2009.
5. The principle of sustainability, Simon Dresner, –Earth Scan publishers (2008).
6. Manufacturing strategy: How to formulate and implement a winning plan, Jhon Miltenburg, Productivity Press Portland, Oregon-2017.
7. Manufacturing strategy, Voss C. A, Chapman & Hall-1992
8. Manufacturing the future, Steve Brown, Prentice Hall, 2000
9. Manufacturing strategy, Terry Hill, Homewood, IL- 1989
10. Becoming Lean - Inside Stories of U.S. Manufacturers, Jeffrey K. Liker, Productivity Press, Portland, Oregon
11. Handbook of Sustainable Manufacturing, G. Atkinson, S. Dietz, E. Neumayer, Edward Elgar Publishing Limited, 2007.
12. Industrial Development for the 21st Century: Sustainable Development Perspectives, D. Rodick, UN New York, 2007.
13. An Introduction to Sustainable Development, P.P. Rogers, , K.F. Jalal & J.A. Boyd, J.A, Earth scan, London, 2007.
14. Sustainable Development Indicators in Ecological Economics, P. Lawn, Edward Elgar Publishing Limited.

15. The Economics of Sustainable Development, S. Asefa, W.E. Upjohn Institute for Employment Research, 2005.

COURSE OUTCOMES:

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

- Recognize the objectives, functions and applications of Production management and allied techniques.
- Categorize and solve different inventory control techniques, forecasting dilemmas, routing problems and scheduling troubles.
- Summarize various aggregate production planning techniques and integrating them to different departments to execute effective PPC functions.
- Inspect organizational performance, production systems, demand trends, location feasibility and cost analysis.
- Elaborate and estimate methods of line balancing, process sheets, production strategies, sales forecasting and maintenance.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	2	3	2	1	2	3	1	1	2	2	1	3	2	2
CO2	-	2	3	2	1	3	3	1	1	2	3	2	3	2	2
CO3	-	2	3	2	1	2	3	1	1	3	3	2	3	3	3
CO4	-	2	3	2	2	3	3	1	1	3	2	2	3	2	2
CO5	-	2	3	2	1	3	3	1	1	2	2	1	3	2	2

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem.	IPUGTP5	Quality & Maintenance Management	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. Define and understand various terms associated with quality control.
2. Enhance the students understanding of the complexity of statistical analysis and interpretation.
3. Provide an introduction to the fundamental concept of SPC, total quality management, six sigma, quality function deployment and applications of these concepts.
4. Analyze the philosophies of TQM in order to better evaluate the TQM implementation proposals.
5. Assess exactly where an organization stands on quality management with respect to ISO 9000 quality management.

COURSE CONTENT:

Module - I

Basic concepts of quality: Inspection definition of quality, quality control cost of quality, value of quality, statistical quality control, need and advantages of SQC

Frequency distribution: Variables & attributes, quality characteristics, theory of control charts, control chart for variable X & R chart, control chart for attribution P, NP, C, chart & process capability.

Module - II

Quality assurance: Quality assurance manual, quality circle, characteristics of quality circle and the process of operation of quality circle, quality policy & procedure & objectives,

Acceptances sampling: Concept of sampling, O-C curve & its construction, sampling plans, single, doubles & multiple sampling plans.

Module - III

Contribution of various quality management gurus: Juran triology, Deming's 14 Points, P-D-C-A wheel, Taguchi's philosophy, design of experiment, old and new seven QC tool of quality, Philip Crosby's zero defect, seven types of waste, 5's.

Module - IV

Introduction to ISO 9000: Various models of ISO 9000, clauses of 9000, total quality control, total quality management, tool for TQC & TQM.

Reliability: Definitions, bathtub curve, design for reliability, failures & causes of failures, FMECA, maintainability & availability, MTBF, reliability models, system with components in series & in parallel, mixed arrangement, fault–tree-technique.

Module - V

Maintenance management: Types of maintenance strategies, breakdown and preventive maintenance, predictive and total productive maintenance, condition monitoring, individual and group replacement policies, make or buy decision, concept of original equipment effectiveness.

Quality function deployment, Kaizen TQM and Six Sigma, Procedure of six sigma.

TEXT & REFERENCE BOOKS:

1. Statistical Quality Control – Grant & Leowowworth, Tata Mc. Hill.
2. Quality Planning & Analysis –Juran & Gryana, Tata Mc. Hill.
3. Total Quality Control – A. Feigenbaum, Mcgraw Hill.
4. Statistical Quality Control – M. Mahajan, Dhanpat Rai Publication.
5. Total Quality Management – Besterfield, Tata Mc. Hill.
6. Total Quality Management – Purnima Charantimath , Low Pearson Education.
7. Total Quality Management – Krishnaiya, PHI.
8. Total Quality Management – Suganthi & Sannuel, PHI.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the importance of quality & role of statistical quality control.

CO2: Apply methods and techniques of statistical quality control, to studies and interpret the results in business.

CO3: Demonstrate motivation and responsibility to advocate for quality in business.

CO4: Develop quality management philosophies and frameworks.

CO5: Develop in-depth knowledge on various tools and techniques of quality management.

Course Outcomes and their mapping with Programme Outcomes and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	-	-	-	3	2	-	2	3	3	3
CO2	3	2	3	2	2	2	-	-	1	-	-	2	3	2	3
CO3	3	-	-	2	1	-	-	-	-	-	-	2	2	2	2
CO4	3	2	2	-	2	-	-	-	-		-	3	3	3	3
CO5	3	2	2	2	2	-	-	-	-	2	-	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem.	IPUGTP6	Power Plant Engineering	3	-	-	15	15	5	5	60	100	3

COURSE OBJECTIVES:

1. To provide the knowledge related to various sources of energy and steam power plant.
2. To provide the knowledge related to solar power plants and solar power plant.
3. To provide the knowledge related to nuclear power station.
4. To provide the knowledge related to geothermal power plant, wind energy and bio gas plant.
5. To provide the knowledge related to direct energy conversion systems.

COURSE CONTENT:

Module - I

Sources of energy: Present power position in India, non-conventional energy and their application, steam power plant, high-pressure boilers and their classification and working, boiler accessories and mountings, condenser and their types.

Module - II

Solar Energy: Solar Insolation calculation, flat plates and concentrating collectors for liquid and gases, construction, collector area calculation, heat removal factor, efficiency.

Solar System: Power plants, low, medium and high temperature plants, solar dryers, solar cookers, solar refrigeration systems, solar panel.

Module - III

Nuclear Energy: Introduction to nuclear engineering, release of energy by nuclear reaction, chain reaction, moderation, components of nuclear reactor, types of reactor, pressured water reactor, CANDU reactor, gas cooled reactor, liquid metal cooled reactor, breeder reactor, nuclear materials.

Module - IV

Geothermal power plant, Wind energy: Sources of geothermal energy and its types, type of rotors, horizontal axis and vertical axis systems, system design and site selection blade material, wind power scenario in India.

Bio Gas Plant: Types, parameters affecting plant performance, plant design.

Module-V

Direct Energy Conversions: Fuel cells, thermo-electric, thermo ionic and MHD systems (magneto hydrodynamic system). Economic analysis of power plant tariffs.

TEXT & REFERENCE BOOKS:

1. Power Plant Engineering - Domkundwar & Arora, Dhanpat Rai Publication.
2. Solar energy - S.P. Sukhatme, TMH Publication.
3. Solar Energy Thermal Processes - Duffie and Beckman, John Wiley.
4. Power plant Engineering - P.K.Nag, TMH Publication.
5. Power Plant Enginering - Wakil, TMH.
6. Non-Conventional Energy Sources - B.H. Khan, TMH Publication.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Demonstrate a basic understanding of various types of power plants.
CO2: Acquire knowledge and hands-on competence in the design and development of mechanical systems associated with power plants.
CO3: Compare different energy resources and choose the most appropriate based on local conditions
CO4: Perform simple techno-economical assessments of energy resources
CO5: Design power plant that meet specific energy demands, which are economically feasible and have a minimal impact on the environment.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	1	1	-	-	-	-	-	-	-	-	1	3	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	3	2	2
CO3	3	2	1	-	-	2	2	-	-	-	-	2	3	1	3
CO4	3	3	3	3	1	-	1	-	-	-	-	1	3	2	2
CO5	3	2	1	-	-	2	3	-	-	-	-	1	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem	IPUGTP7	Advanced Manufacturing Processes	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. To understand the principle of Mechanisms of chip formation, shear angle relations, and cutting forces in orthogonal cutting and machining economics.
2. To impart knowledge about newer machining process and their mechanism of material removal,
3. To understand about various advanced metal forming processes and its applications.
4. To impart knowledge about various advanced welding processes for joining materials.
5. To impart knowledge about various advanced casting processes and its applications.

COURSE CONTENT:

Module – I

Advanced machining theory & practices: Mechanisms of chip formation, shear angle relations, and theoretical determination of cutting forces in orthogonal cutting, analysis of turning, drilling and milling operations, tool wear, economics of machining

Module – II

Introduction, micro machining process, principle, material removal mechanism, parametric analysis and applications of processes such as ultrasonic machining (USM), abrasive jet machining (AJM), water jet machining (WJM), abrasive water jet machining (AWJM), electrochemical machining (ECM), electro discharge machining (EDM), electron beam machining (EBM), laser beam machining (LBM) processes, working principle of plasma arc machining.

Module – III

Advanced metal forming processes: Details of high energy rate forming (HERF) process, electro-magnetic forming, explosive forming electro-hydraulic forming, stretch forming, contour roll forming.

Module – IV

Advanced welding processes: Details of electron beam welding (EBW), laser beam welding (LBW), ultrasonic welding (USW), cold welding, diffusion welding, forge welding, friction welding, explosive welding, hard vacuum welding, soft vacuum welding, underwater welding processes, concept of robotized welding and welding automation.

Module -V

Advanced casting processes: Metal mould casting, continuous casting, squeeze casting, vacuum mould casting, evaporative pattern casting, ceramic shell casting.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for Engineering Materials, Serope Kalpakjian, Steven R. Schemid, Fourth edition, Pearson Education.
2. Manufacturing Engineering and Technology, Serope Kalpakjian, Third Edition, Addison-Wesley Publication Co.,
3. Materials and Processes in Manufacturing, E.P. DeGarmo, J. T Black, R.A. Kohser, 8th Edition, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
4. Manufacturing Science, A. Ghosh & A.K. Mallik, East-West Press Pvt. Ltd. New Delhi.
5. Non-traditional Manufacturing Processes, G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7)
6. Advanced Machining Processes, V.K. Jain, Allied Publishers Pvt. Ltd.
7. Modern Machining Processes, P.C Pandey & H.S. Shan, McGraw Hill Education.
8. Manufacturing Technology, P. N Rao, Tata McGraw Hill Publishing Company.
9. Non-Conventional Machining, P. K Mishra, Narosa Publishers.
10. Unconventional Manufacturing Processes, K. K Singh, Dhanpat Rai & Company, New Delhi.

COURSE OUTCOMES:

At the end of the course the students will be able to:

1. Analyse Mechanisms of chip formation, different material removal processes and its significance to manufacture end product with the aim of economic machining time.
2. Estimate process parameters affecting the product quality in various advanced machining of metals.
3. To select and understand about various advanced metal forming processes and its applications with the aim of cost reduction
4. To evaluate and analyse of the different advanced welding process to select most suitable welding procedure and consumables for a product.
5. Basic understanding of advanced casting processes and able to analyse real-life application in various organizations.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	1	1	2	1	2	2
CO2	2	2	2	1	-	-	-	-	-	1	1	2	1	2	2
CO3	1	2	2	2	-	-	-	-	-	1	1	2	2	2	2
CO4	2	3	3	3	-	-	-	-	-	1	1	2	2	2	2
CO5	2	2	2	3	-	-	-	-	-	2	1	2	1	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem.	IPUGTP8	Turbo Machinery	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

CLO1: Developed the concept of boundary layer theory and formulation of basic equations involved in impact of free jets.

CLO2: To visualize flow patterns over a bank of cylinders, measurement of flow rate, pumping power of fluid flow through duct and reaction force of jet impact.

CLO3: To demonstrate performance characteristics of turbines.

CLO4: Concepts lying in construction, working, and performance of various pumps.

CLO5: Importance of hydraulic machines and its industrial application.

COURSE CONTENT:

Module – I

Boundary layer concepts**:** Boundary layer thickness, types and characteristics, momentum equation, laminar and turbulent boundary layer.

Flow around submerged bodies: Force exerted by flowing fluid on a body: drag and lift; stream lined and bluff body, drag on sphere and cylinder, lift on circular cylinder and air foil.

Impact of free jets: Force exerted by the jet on stationary flat, curved plate, hinged plate, moving plate and moving curve vanes.

Module – II

Hydraulic Turbines: Classification of hydraulic turbines, impulse and reaction turbines, construction, working and analysis of Pelton, Francis and Kaplan turbines, work done, efficiencies, draft tube, specific speed, performance curves for turbines, governing of the hydraulic turbines, cavitations.

Module – III

Centrifugal Pumps: Pump classification, and selection criterion, construction, working principle, velocity vector diagrams, work done, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, pressure rise in impeller, characteristic curves, priming**,** cavitation.

Module -IV

Reciprocating Pumps: Principle, classification, component and working, single acting and double acting, discharge, work done and power required, coefficient of discharge, indicator diagram and its variations, work saved by fitting air vessels.

Module – V

Axial flow pump: Construction, working principle, velocity vector diagrams, work done and its efficiency.

Hydraulic machines: Hydraulic press, hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic jack, hydraulic lift, hydraulic ram, fluid couplings, fluid torque converter air lift pump, and jet pump.

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics – P. M. Modi and S. M. Seth, Standard Book House.
2. Textbook of Fluid Mechanics & Hydraulic Machines – Sukumar Pati, McGraw Hill, 2022.
3. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som & G. Biswas, TMGH
4. Fluid Mechanics & Machinery–Agarwal, TMGH.
5. Fluid Mechanics & Machinery –Kothandraman & Rudra Mourthy, New Age Publication.

REFERENCE BOOKS:

1. Fluid Mechanics and fluid power Engineering - D.S Kumar, S.K. Kataria and sons, 2015.
2. Experiment in Hydraulics & Hydraulic Machine –Shesha Prakash- PHI
3. Fluid Mechanics & Turbo Machine–Das- PHI
4. Fundamentals of Turbo Machine –Venkanna- PHI
5. Introduction to Hydraulics & Pneumatics–Ilargo & Soundarajan- PHI.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Acquire knowledge and hands-on competence in applying the concepts of fluid machinery in the design and development of mechanical systems.
CO2: Estimate head and pump efficiency under various operating conditions
CO3: Estimate the performance of impulse and reaction turbines and calculate the output power and turbine efficiency under various operating conditions
CO4: Discuss centrifugal and reciprocating pumps using velocity triangles
CO5: Calculate the flow characteristics and performance of hydraulic machines for real time applications

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	2	2	2	3	1	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	3	2	1	2	-	-	-	-	1	3	2	2
CO3	3	3	2	2	1	1	1	-	-	-	-	1	3	2	2
CO4	3	3	2	2	-	-	-	-	-	-	-	1	3	2	2
CO5	2	2	1	1	-	-	-	-	-	-	-	-	2	1	1

Weightage 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination Assessment	Total Marks	
			L	T	P	CIA				SEA		
						CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem	IPUGTP9	Heat & Mass Transfer	3	-	-	15	15	5	5	60	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. To provide the basic principles of heat transfer due to conduction, convection and radiation.
2. To provide the knowledge of fin design to enhance the heat transfer in real time situation.
3. To provide the fundamentals of convection process and distinguish between natural and forced convection.
4. To design novel heat exchangers for domestic and industrial use.
5. To provide the knowledge radiation heat transfer.

COURSE CONTENT:

Module - I

Basic concepts: Modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process; **Conduction:** Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one dimensional steady state conduction through a slab, tubes, spherical shells and composite structure, critical thickness of insulation for pipes, effect of variable thermal conductivity.

Module - II

Extended surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross section area, heat dissipated by a fin, effectiveness and efficiency of fin, applications; **Transient (Unsteady) heat conduction:** Transient and periodic conduction, heating and cooling of bodies with known temperatures distribution, system with infinite thermal conductivity, response of thermocouples.

Module - III

Convection: Introduction, free and forced convection; principle of dimensional analysis, application of dimensional analysis of free and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.

Module - IV

Heat Exchangers: Types- parallel flow counter flow; evaporator and condensers, overall heat transfer coefficient, log mean temperature difference (LMTD), method of heat transfer analysis, effectiveness of heat exchanger, NTU method.

Module-V

Thermal radiation: nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces; radiation exchange between black and grey surface, shape factor, analogical electrical network, radiation shields.

TEXT & REFERENCE BOOKS:

1. Heat Transfer : A Practical Approach – Yunus A. Cengel, John M. Cimbala, McGraw Hill Edu. Publications, 2015.
2. Heat Transfer - J.P. Holman, TMH
3. Fundamentals of Heat and Mass Transfer - Frank P. Incropera, David P. Dewitt, Wiley.
4. Dutta Binay K; Heat Transfer; PHI
5. Heat transfer - S.P. Sukhatme, TMH.
6. Heat & Mass Transfer- P K Nag, TMH Publications.
7. Heat & Mass Transfer – D.S Kumar, S.K. Kataria and sons, 2015
8. Heat & Mass Transfer - Arora and Domkundwar, Dhanpat Rai Publications.
9. Heat Transfer - C.P. Arora, TMH.
10. Heat & Mass Transfer - R.C. Sachdeva, New Age Publications.
11. Heat & Mass Transfer Data Book – C P Kothandaraman S Subramanyan, New Age International Publishers.

COURSE OUTCOMES:

At the end of the course the students will be able to:

CO1: Understand the basic modes of heat transfer and compute the temperature distribution in steady and unsteady state heat transfer through conduction.
CO2: Heat transfer analysis of extended surfaces.
CO3: Interpret and analyse forced and free convection.
CO4: Understand the principle of radiation, evaluation of heat transfer by radiation between different geometries.
CO5: Design and analysis of heat exchanger.

Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
CO1	3	-	-	-	2	-	-	-	-	-	-	1	3	2	2
CO2	3	3	2	2	2	-	-	-	1	-	-	1	3	2	2
CO3	3	3	2	2	1	1	-	-	-	-	-	1	3	1	2
CO4	3	3	2	2	-	1	1	-	-	-	-	1	3	2	-
CO5	3	2	3	2	1	1	-	-	1	1	-	1	2	2	1

Weightage 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
B. Tech VII Sem	IPUGLT1	Computer Integrated Manufacturing Lab	2	-	-	25	25	50	1

Semester	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme						Credit
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment				Semester Examination	Total Marks	
						CIA				SEA		
			L	T	P	CT–1	CT–2	Assignment, surprise test, quiz test etc	Attendance			
B. Tech VII Sem	IPUGSL1	Industrial Training Seminar	-	-	-	-	-	-	-	-	-	-

Note:

As per the B. Tech. Ordinance, all the students have to mandatorily go through Summer training/industry based field experience/ internship in the summer vacation after completion of 6th semester ESE examination. The duration for this will be Minimum 04 (Four) weeks. It is an integral part of course curriculum of B. Tech degree. All the students have to submit the summer training certificate along with the report. Also in this semester they have to give oral presentation.

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
NEP–Scheme of Teaching& Examination
W.E.F. Session: 2025-2026
B. TECH FOURTH YEAR, VIII SEMESTER

SN	Course No.	Subject	Teaching Hours/ Week/ Periods			Evaluation Scheme			Credits
			Theory Lectures	Tutorials	Practical	Continuous Internal Assessment	Semester Examination Assessment	Total Marks	
			L	T	P	CIA	SEA		
1	IPUHPF1	Major Project (Preferably Industry Based)	–	–	16	200	200	400	8
Total			–	–	**16**	200	200	400	**8**
GRAND TOTAL			–	–	**16**	**200**	**200**	**400**	**8**

Approved in BOS meeting held on 28.06.2024