GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG

SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY

Department of Industrial & Production Engineering

CBCS–New, Scheme of Teaching& Examination

W.E.F. Session: 2021–22

B. TECH SECOND YEAR, III SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
1.	MA203TBS05	Numerical Methods	3	1	–	30	70	100	4
2.	IP203TES06	Engineering Thermodynamics	3	1	–	30	70	100	4
3.	IP203TPC01	Strength of Materials	3	1	–	30	70	100	4
4.	IP203TPC02	Theory of Machines	3	1	–	30	70	100	4
5.	IP203TPC03	Manufacturing Processes– I	3	–	–	30	70	100	3
Total			**15**	**4**	**–**	**150**	**350**	**500**	**19**
PRACTICALS									
1.	IP203PPC01	Theory of Machines Lab	–	–	2	30	20	50	1
2.	IP203PPC02	Material Testing Lab	–	–	2	30	20	50	1
3.	IP203PBS03	Programming in C & MATLAB	–	–	2	30	20	50	1
Total			**–**	**–**	**6**	**90**	**60**	**150**	**3**

Total Credits: **22**

Total Contact Hour: **25**

Total Marks: **650**

INTERNAL ASSESSMENT: – Two class tests of 15 marks each will be conducted.

L–LECTURE, T–TUTORIAL, P–PRACTICAL, ESE –END SEMESTER EXAMINATION

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	MA203TBS05	Numerical Methods	3	1	0	15	15	70	100	4

COURSELEARNINGOBJECTIVES:

The objective of this course is to:

1. Provide the information related to existence and uniqueness criteria applied to numerical methods.
2. Providing the knowledge ofconvergences criteria and awareness of reasons behind the failure of numerical methods.
3. Find numerical approximations to the roots of equation by various method.
4. Find numerical solution to a system of linear equations by Gaussian elimination and Gauss–Siedel iterative etc.
5. Learn thenumerical solution for ordinary differential equation.

COURSE CONTENT:

Module – I

Introduction of errors and their analysis, types of errors, numerical problems on error analysis. Curve fitting: method of least squares, fittings of straight line and parabola and by method of moments.

Module –II

Numerical solution of algebraic and transcendental equations: Secant method, Regula–falsimethod, Newton Raphsonmethod.Solution of a system of simultaneous linear algebraic equations direct method: Gauss elimination method, Iterative methods, Gauss Seidel iterative method.

Module –III

Calculus of finite differences: Finite differences, difference formula, operators and relation between operators,inverse operator.Interpolation with equal intervals: Newton's forward and backward interpolation formula. Interpolation with unequal intervals: Lagrange's interpolation.

Module –IV

Numerical differentiation and integration: Numerical differentiation,maxima and minima of a tabulated function.Numerical integration:Trapezoidal rule, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rule, Boole's rule, Weddle rule.

Module–V

Numerical solution of ordinary differential equation: Taylor series method, Euler's method, modified Euler method, Runge's method, Runge Kutta method.

COURSE OUTCOMES:

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

CO1. Apply knowledge of numerical analysis for understanding, formulating and solving engineering problems.

CO2. Identify, analysis, and solve mechanical engineering problems useful to the society.

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

TEXT & REFERENCE BOOKS:

1. Numerical methods for scientific and engineering computations–Jain &Iyngar, New Age International Publications.
2. Numerical analysis – G.S. RAO, New Age International Publications.
3. Numerical methods in engineering and science– B.S.Grewal, Khanna Publishers.
4. Advanceengineering methods – H. K. Das, S. Chand Publications.
5. Computer oriented numerical methods V.Rajaraman, PHI Learning Publications.

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	1	1							2	1	2	1
CO2	3	2	2	2	1							2	3	2	2
CO3	3	3	2	3	2							2	1	2	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP203TES06	Engineering Thermodynamics	3	1	–	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Learn the fundamentals principles of classical thermodynamics and prepare them to apply basic conversion principles of mass and energy to closed and open systems.
2. Applications of laws of thermodynamic while solving engineering problems.
3. Understand second law of thermodynamics and apply it to various systems, note the significance of the results and to know about entropy and second lawaspects of daily life.
4. Importance of pure substances and analyzethe performance of thermodynamic air and of vapour power cycles.

COURSE CONTENT:

Module –I

Basic concepts: Concept of continuum, macroscopic and microscopic approach.

Thermodynamic systems: Closed, open and isolated system,property, state, path and point function, process, quasi-static process, work, modes of work transfer, Zeroth law of thermodynamics, concept of temperature and heat, concept of ideal and real.

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

Module –II

Second law of thermodynamics: Thermal energy reservoirs, second law, Carnot cycle, Carnot theorem, thermodynamic temperature scale, Carnot heat engine, refrigerator and heat pump, Clausius inequality, concept of entropy, principle of entropy, reversible and irreversible processes, entropy change during process, available and un-available energy, availability for closed and open system, Third law of thermodynamics.

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, Binary vapour 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.Thermal Radiation: black and non-black bodies, Kirchhoff's law, intensity of radiation, radiation exchange between black surface, geometric configuration factors.

COURSE OUTCOMES:

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

CO1. Understand the concepts such as conservation of mass, conservation of energy, work interaction, heat transfer and first law of thermodynamics.

CO2. Identify closed and open systems and analyze related problems.

CO3. Apply the concept of second law to design simple systems.

CO4. Analyze the performance of gas and vapor power cycles and identify methods to improve thermodynamic performance.

CO5. Demonstrate the importance of phase change diagrams of various pure substances.

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, John Wiley & 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.

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

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs 1	PSOs 2	PSOs 3
CO1	3	3	2	3	-	-	1	-	-	-	-	1	3	2	-
CO2	3	3	3	2	-	-	-	-	-	-	-	1	3	2	
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	1	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-

CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	-	-

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP203TPC01	Strength of Materials	3	1	–	15	15	70	100	4

COURSELEARNINGOBJECTIVES:

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 parameter 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, 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.

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.

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.

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	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

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP203TPC02	Theory of Machines	3	1	–	15	15	70	100	4

COURSELEARNINGOBJECTIVES:

The objective of this course is to:

1. Impart knowledge of various types of links, mechanisms and machines and kinematics inversions.
2. Familiarize the kinematics of mechanisms by drawing the velocity and the accelerations diagrams.
3. Solving practical problems related to design of linkage mechanisms and cam and follower systems to generate specified output motions.
4. Learn the importance of kinematics behind gear, gear trains and fundamental principles of flywheel.
5. Explain 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

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centre, velocity and acceleration analysis using loop closure equations kinematic analysis of simple mechanisms,slider crank mechanism dynamics, coincident points,Coriolis component of acceleration, introduction to linkage synthesis, three position graphical synthesis for motion and path generation.

Module –III

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 –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 ofepicyclic gear trains.

Module –V

Turning moment of Flywheel: Function of a flywheel, crank effort diagrams, fluctuation of speed and energy, effect of centrifugal tension of flywheel, inertia torque and its effects on crank effort diagrams.

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.

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: Analyse the position, velocity and acceleration of mechanisms.

CO3: Construct cam profiles and analysis of their velocity and acceleration.

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.

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.

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	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

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech III Sem.	IP203TPC03	Manufacturing Processes–I	3	–	–	15	15	70	100	3

COURSELEARNINGOBJECTIVES:

The objective of this course is to:

1. Understand the principle, concept, thermal and metallurgical aspects during solidification of metal.
2. Demonstrate about principles/ methods of casting with detail design of gating/ riser system needed for casting, defects in cast objects and requirements for achieving sound casting.
3. Evaluate foundry practices like pattern making, mould making, core making and inspection of defects.
4. Build knowledge about principles and criteria of yielding during forming of metals, analysis of different bulk metal forming processes following different analysis approach.
5. Understand the application of jigs and fixtures.
6. Analyze various metal forming processes and plastic deformation during forming processes.

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.

Drawing: Drawing process geometry and analysis of wire and sheet drawing for load and power calculations, maximum reduction possible.

Rolling: Classification of rolling, process geometry and analysis of plate rolling for rolling load, rolling pressure and power calculations, defects in rolled products.

Forging: Classification of Forging, determination of forces in disc forging considering sticking and slipping, forging defects.

Extrusion: Classification, process geometry and analysis of rod and sheet extrusion for load and power calculations, maximum reduction possible, defects in extruded product.

Module –V

Work holding device: Introduction to jigs, fixtures and their types, design criteria, economic justification, fundamental principles of design of jigs and fixtures, location and clamping in jigs and fixtures, drilling jigs, milling fixtures, indexing jigs and fixtures.

COURSE OUTCOMES:

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

CO1. Decide yield of a material according to different yield theory for a given state of stress.

CO2. Analyze the different bulk metal forming process mechanics using different analysis approach and calculate the force, power requirements etc.

CO3. Evaluate the effect of process parameters on the process mechanics during bulk metal forming.

CO4. Select appropriate design of gating systems and manufacturing processes in order to design products.

CO5. Identify the various metal forming techniques and the theory of plasticity and its application for analyzing various metal forming Processes.

CO6. Select appropriate jigs and fixtures in various engineering applications.

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.

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	-	-	-	-	2	1	2	2	2
CO2	3	2	1	2	1	2	2	1	-	-	2	2	3	3	3
CO3	3	2	2	2	2	1	2	2	-	-	2	3	2	3	3
CO4	3	2	2	2	2	2	2	1	-	-	2	2	2	3	3
CO5	3	1	2	2	1	2	2	1	-	-	2	2	2	2	3
CO6	2	2	2	2	1	2	2	-	-	-	1	2	1	2	1

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

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Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.Tech III Sem.	IP203PPC01	Theory of Machines Lab	–	–	2	30	20	50	1

COURSELEARNINGOBJECTIVES:

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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.Tech III Sem.	IP203PPC02	Material Testing Lab	–	–	2	30	20	50	1

COURSELEARNINGOBJECTIVES:

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):

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

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.Tech III Sem.	IP203PBS03	Programming in C & MATLAB	–	–	2	30	20	50	1

COURSELEARNINGOBJECTIVES:

The objective of this course is to:

1. Familiarize the student in introducing and exploring MATLAB & C software's.
2. Enable the student on how to approach for solving engineering problems using simulation tools.
3. Prepare the students to use MATLAB/C in their project works.
4. Provide a foundation in use of this software's for real time applications

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

1. Write a program in 'C' to find simple interest'
2. Write a program in 'C' to calculate sum of three numbers.
3. Write a program in 'C' to calculate number of months and days.
4. Write a program in 'C' to find whether a year is leap or not.
5. Write a program in 'C' to convert the given temperature in Fahrenheit to Celsius.
6. Write a program in 'C' to find whether a number is odd or even.
7. Write a program in 'C' to calculate factorial of a given number.
8. Write a program in 'C' to find the real roots of a quadratic equation.
9. Write a program in 'C' for secant method.
10. Write a program in 'C' for Newton Raphson method.
11. Write a program in 'C' for Regula Falsi method.
12. Write a program in 'C' for Gause elimination and Gause Seidel methods.
13. Write a program in 'C' for Lagrange's interpolation.
14. Write a program in 'C' for Simpson Rule.
15. Write a program in 'C' for Euler method and Runge- Kutta Method.
16. A programme to show conversion from string to integer and vice versa.
17. To know the history and features of MATLAB & the local environment of MATLAB.
18. Find the roots of equations find the values at different points and plot the graph.
19. Find the derivative of an equation in MATLAB.
20. Find the area enclosed between the curves in MATLAB.
21. Find the addition, subtraction, multiplication, transpose and inverse of matrices.
22. Find the rank: Eigen values and Eigen vector of matrices.

23. Write a program to find the roots of an equation using Bi–section method, Regula–falsi method and Newton Raphson method.
24. Plot the surface for an equation using MATLAB.

COURSE OUTCOMES:

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

CO1. Perform the programming & simulation for engineering problems.

CO2. Learn importance of this software for lab experimentation.

CO3. Articulate importance of software's in research by simulation work.

CO4. In-depth knowledge of providing virtual instruments on C language environment.

CO5. Ability to write basic mathematical, numerical method problems in MATLAB.

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
CO5	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 IN ENGINEERING AND TECHNOLOGY

Department of Industrial & Production Engineering

CBCS–New, Scheme of Teaching & Examination

W.E.F. Session: 2021–22

B. TECH SECOND YEAR, IV SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
1	IP204TPC04	Marketing Management	3	–	–	30	70	100	3
2	IP204TPC06	Fluid Mechanics	3	1	–	30	70	100	4
3	MA204TBS06	Statistical Methods	3	1	–	30	70	100	4
4.	IP204TPC05	Material Science	3	–	–	30	70	100	3
5.	IP204TPC07	Manufacturing Processes–II	3	–	–	30	70	100	3
6.	EN204THS02	Business Communication and Presentation Skill	3	–	–	30	70	100	3
Total			**18**	**2**	**–**	**180**	**420**	**600**	**20**
PRACTICALS									
1.	IP204PPC03	Modelling Software Lab	–	–	2	30	20	50	1
2.	IP204PPC04	Fluid Mechanics Lab	–	–	2	30	20	50	1
Total			**–**	**–**	**4**	**60**	**40**	**100**	**2**

Total Credits: **22**

Total Contact Hour: **24**

Total Marks: **700**

INTERNAL ASSESSMENT: –two class tests of 15 marks each will be conducted.
L–LECTURE, T–TUTORIAL, P–PRACTICAL, ESE –END SEMESTER EXAMINATION

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B. Tech IV Sem.	IP204TPC04	Marketing Management	3	0	–	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Explain about basic concepts of marketing and selling.
- Demonstrate importance of need, wants and demand.
- Analyse implicating strategies in different phases of product lifecycle.
- 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, analysing 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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech IV Sem.	IP204TPC06	Fluid Mechanics	3	1	–	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

CLO1-Explain fundamentals of fluid mechanics, which is used in the applications of aerodynamics, hydraulics, marine engineering, gas dynamics etc.

CLO2-Develop an understanding about hydrostatic law, principles of buoyancy and stability of a floating body and its application on mass, momentum and energy equation in fluid flow.

CLO3-Explain basic laws and equations used for analysis of static and dynamic fluids.

CLO4-Inculcate the importance of fluid flow measurement and its applications in industries.

CLO5-Determine the losses in a flow system, flow through pipes and flow past immersed bodies.

COURSE CONTENT:

Module – I

Introduction of Fluid: Introduction, continuum, density, specific weight, specific gravity, kinematic and dynamic viscosity, variation of viscosity with temperature, Newton law of viscosity, vapour pressure, boiling point, cavitation, surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Fluid Statics: Fluid Pressure, pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Hydrostatic pressure and force: horizontal, vertical andand inclined surfaces. Buoyancy and stability of floating bodies.

Pressure measurement devices: Piezometer, U–tube manometer, single column manometer, U–tube differential manometer, micro–manometers, pressure gauges.

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. One, two and three – dimensional continuity equations in Cartesian coordinates.

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, Venturimeter, Orifice meter and Pitot tube, momentum principle, forces exerted by fluid flow on pipe bend, vortex flow: free and forced.

Module –IV

Dimensional analysis and dynamic similitude: Definitions of 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: Reynold's experiment, flow of viscous fluids in circular pipe, shear stress and pressure gradient relationship, velocity distribution, Hagen-Poiseuille equation, flow of viscous fluids between two parallel plates (Counter flow), shear stress and pressure gradient relationship, velocity distribution, drop of pressure head.

Turbulent Flow: Effect of turbulence, expression for loss of head due to friction in pipes (Darcy-Weisbach equation) and expression force-efficient of friction in terms of shear stress.

Flow through pipe: Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe power transmission through pipe, water hammer in pipes.

TEXT & REFERENCE BOOKS:

1. Fluid Mechanics and Machinery–C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.
2. Hydraulics and Fluid Mechanics–P. M. Modi and S. M. Seth, Standard Book House.
3. Theory and Applications of Fluid Mechanics–K. Subramanya, Tata McGraw Hill.
4. 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 and Solve problems based on mass, momentum and energy conservation and fluid properties.

CO2- Relate different fluid properties with flow characteristics.

CO3- Knowledge of dimensional analysis and physical significance of dimensionless numbers as well as the concept of drag and lift in viscous fluid flow and losses due to viscous flow in pipes

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

CO5- Develop the analytical skills in designing the pipe line and losses in pipes.

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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech IV Sem.	IP204TPC07	Manufacturing Processes – II	3	–	–	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional machining methods.
- Explain the fundamentals of various metal removal processes by multi point cutting tools.
- Determine various methods of machining/ manufacture of gears used in power transmission.
- Demonstrate the fundamental parts of various machine tools and their kinematic schemes.
- Demonstrate various machine tools and to familiarize with the different types of machine tool drives.

COURSE CONTENT:

Module – I

Sheet metal working: Role of sheet metal components, cutting mechanism, description of cutting processes like blanking, piercing, lancing etc., description of processes like deep drawing, bending, coining, embossing etc., basic elements of presses for sheet metal working, punch and die clearances, die elements.

Module –II

Lathe: Lathe design and terminology specification, types of lathe: centre lathe, capstan and turret lathe, various operations performed on lathe, operating conditions calculation of material removal rate.

Drilling: Fundamental of drilling process, types of drilling machine, types of drills, geometry of twist drill, and various operations performed on drilling machine.

Boring: Introduction to boring, reaming, tapping and taps, other hole making operations.

Module –III

Milling: Milling machine, milling cutters, milling process: up milling, down milling, different type of milling operation: end milling, plain milling, side and face milling, work holding devices for milling, indexing and types, operating condition, calculation of material removal rate.

Broaching: Introduction to broaching, fundamental of broaching, broaching machine.

Module –IV

Shaping: Introduction to shaping, shaping operation, types of shaping machine, mechanism of quick return motion, operating conductions, calculation of material removal rate.

Planning: Introduction to planning, planning operation, types of planning machine, operating conditions, calculation of material removal rate.

Module –V

Gear Manufacturing: Introduction to gear cutting, gear types, gear manufacturing processes: gear forming, gear shaping, gear planning, gear hobbling etc, gear finishing, gear inspection.

Plastic Working: Plastic processing, injection, compression & blow moulding, plastic design principles processes, machines and equipment's, parameters and force calculations.

COURSE OUTCOMES:

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

- Understand the different sheet metal working methods employed for making different products

- Recognize the different conventional machining methods employed for making different products
- Select a machining operation and corresponding machine tool for a specific application in real time.
- Identify basic parts and operations of machine tools including lathe, shaper, planer, drilling, boring, milling and broaching machine.
- Apply the plactic processing principles in injection, compression & blow moulding process along with their parameter and process control.

TEXT & REFERENCE BOOKS:

1. Manufacturing processes for engineering materials (5th Edition) - Kalpakjian and Schmid, Pearson India.
2. A Course in Workshop Technology, Vol II – B. S. Raghuwanshi, Dhanpat Rai& Co.
3. Fundamentals of Metal Machining and Machine Tools- G. Boothroyd, CRC press, 3rd edition.
4. Elements of Workshop Technology Vol. I – Hazra Choudhary, Dhanpat Rai Publication, New Delhi
5. Production Technology- R. K. Jain, Khanna Publications.

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	2	2	1	1	2	2	1	-	-	-	2	2	2	1
CO2	2	3	2	1	1	2	2	1	-	-	-	2	2	3	1
CO3	3	3	2	2	2	1	2	2	-	-	-	2	2	3	2
CO4	2	2	1	1	2	2	1	1	-	-	-	1	1	2	2
CO5	3	2	1	1	1	1	2	1	-	-	-	2	2	2	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech IV Sem.	MA204TBS06	Statistical Methods	3	1	–	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Demonstrate knowledge of probability and the standard statistical distributions.
- Demonstrate understanding of how to design experiments and surveys for efficiency.
- Demonstrate the ability to perform complex data management and analysis.
- To enable the students to deal with uncertainty problems.
- To enable the students to establish the relation among the statistical data.

COURSE CONTENT:

Module – I

Introduction to statistics, mathematical statistics, variable, frequency distribution, type of series, measure of central tendency various types of averages, mean median mode for grouped and ungrouped data, measure of dispersion.

Module – II

Curve fittings by method of least square, straight line parabola correlation, Karl Pearson's coefficient of correlation, limits for correlation coefficient, rank correction, regression linear regression, equation to the line of regression, regression coefficient, angle between two lines of regression.

Module – III

Theory of probability: Mathematical and statistical definition of probability sample space, finite sample space sample point, events theorem of total probability, sample and compound event, conditional probability, theorem of compound probability, Baye's theorem.

Module – IV

Theoretical distribution: Binominal distribution mean, standard deviation, Poisson distribution, mean, and standard deviation, normal distribution: mean and standard deviation.

Module – V

Random and simple sampling: Mean standard deviation in simple sampling of attribute, test of significant for large sample test of significance based on Chi square, T, F and Z distribution degree of freedom, condition for applying Chi-square test.

TEXT & REFERENCE BOOKS:

1. Mathematical Statistics– M. Roy, Ram Prasad Publications, Agra.
2. Probability & Statistics –P.C. Biswal, PHI Learning.
3. Statistics Analysis– A.A. Afti, Orioited Approach Academic Press.
4. Fundamental of Mathematical Statistics– S. C. Gupta and Kapoor, Sultan Chand and Sons, 1980.

COURSE OUTCOMES:

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

- Analyse and apply measures of location and measures of dispersion grouped and ungrouped series.
- Apply discrete and continuous probability distributions to various business problems.
- Perform test of hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases and learn the concept of p–values.
- Learn non–parametric test such as the Chi–square test for independence as well as goodness of fit.
- To enable the students to analyze data and draw appropriate statistical conclusions.

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	1	1	1	3		-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	3	1	-	-	-	-	-	-	-	1	1	2
CO3	2	2	1	3	1	-	-	-	-	-	-	-	1	2	1
CO4	1	1	1	3	-	-	-	-	-	-	-	-	1	1	2
CO5	1	1	-	3	1	-	-	-	-	-	-	-	1	1	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech IV Sem.	IP204TPC05	Material Science	3	-	–	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To Classify the material and select the material for different application.
- Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
- To apply different theory of failure and predict the failure in material.
- To know different phases and heat treatment methods to tailor the properties of Fe–C alloys.

COURSE CONTENT:

Module – I

Crystal Structure: Unit cells, metallic crystal structures, ceramics. Imperfection in solids: point, line, interfacial and volume defects, dislocation strengthening mechanisms and slip systems, critically resolved shear.

Module – II

Mechanical property measurement: Tensile, compression and torsion tests, Young's modulus, relations between true and engineering stress–strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery.

Hardness: Rockwell, Brinell and Vickers and their relation to strength.

Module – III

Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von–mises, maximum normal stress, Mohr–Coulomb and modified Mohr–Coulomb.

Fracture mechanics: Introduction to stress intensity factor approach and Griffith criterion.

Fatigue failure: High cycle fatigue, stress–life approach, SN curve, endurance and fatigue limits, effects of mean stress using the modified Goodman diagram, fracture with fatigue.

Module – IV

Introduction to non–destructive testing (NDT) alloys, substitutional and interstitial solid solutions. Phase diagrams: interpretation of binary phase diagrams and microstructure development, eutectic, peritectic, peritectoid and monotectic reactions. Iron, iron–carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron.

Module – V

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe–C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties: austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo–nitriding, flame and induction hardening, vacuum and plasma hardening alloying of steel.

Properties of stainless steel and tool steels, maraging steels, cast irons, grey, white, malleable and spheroidal cast irons, copper and copper alloys, brass, bronze and cupro–nickel, aluminium and Al–Cu– Mg alloys, nickel based super alloys and titanium alloys.

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.

COURSE OUTCOMES:

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

- Explain and analyse the effect of crystal structure on the properties of material.
- Apply the knowledge of material science for selection of best material in various application of engineering.
- Compare the material properties of ferrous and non-ferrous material.
- Analyse the heat treatment process and relate cooling rate on the properties of material.

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	1	2	1	-	1	-	-	1	-	-	1	-	-	-	-
CO2	2	1	1	2	1	-	-	-	-	-	-	-	1	1	2
CO3	2	-	-	2	2	-	-	-	-	-	-	-	1	2	1
CO4	1	1	1	2	-	-	-	-	-	-		-	1	-	2
CO5	1	1		2	1	-	-	-	-	-	-	-	1	1	1

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

COURSE LEARNING OBJECTIVES:

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB–TOTAL	
						CT–1	CT–2			
B.Tech IV Sem.	EN204THS02	Business Communication and Presentation Skill	3	–	–	15	15	70	100	3

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:

1. Organizational Behaviour – Fred Luthans, McGraw Hill.
2. Report writing for Business – Lesikar and Petit.
3. Effective Technical Communication – M. Ashraf Rizvi, McGraw Hill.

4. 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:

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

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	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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.TechIV Sem.	IP204PPC03	Modelling Software Lab	–	–	2	30	20	50	1

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To make the students understand and interpret drawings of machine components
- Prepare assembly drawings both manually and using standard CAD packages
- Familiarize the students with Indian Standards on drawing practices and standard components
- Gain practical experience in handling 2D drafting and 3D modelling software systems.
- Exposure to software tools needed to analyze engineering problems.
- Expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS:

1. Introduction to CAD (layout and sketching, elements of drawing, draw commands).
2. Understanding the 3D function / tool bars in CAD software.
3. How to draw sketch for 3D modelling?
4. 3D modelling of different components using CAD software.
5. Drawings of different components using CAD software.
6. Surface modelling of different mechanical components in CAD software.
7. Presenting different orthographic/isometric views of 3D models in CAD.
8. Assembly of different mechanical component.

COURSE OUTCOMES:

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

- Follow the drawing standards, fits and tolerances.
- Re-create part drawings, sectional views and assembly drawings as per standards.
- Draw 3D and assembly drawing using CAD software.

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	1	1	1	-	-	-	-	-	-	2	-	-	-	1	-
CO2	2	2	1	2	1	-	-		-	-	-	-	1	-	2
CO3	2	2	-	1	1	-	-	1	-	-	-	-	-	2	1
CO4	1	1	1	2		-	-	-	-	-	-	-	1		2
CO5	1	1	-	1	1	-	-	-	-	-	-	-	1	1	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB–TOTAL	
B.Tech IV Sem.	IP204PPC04	Fluid Mechanics Lab	–	–	2	30	20	50	1

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- Provide practical knowledge in verification of principles of fluid flow.
- Demonstrate the classical experiments in fluid mechanics.
- Correlate various flow measuring devices such as Venturimeter, orifice meter and notches etc.
- Impart knowledge in measuring pressure, discharge and velocity of fluid flow
- 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:

- Present experimental results in the form of written report.
- Measure pressure, velocity and flow rate.
- 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.
- Analyze practical problems related to peer industries such as power plants, chemical industries etc.
- Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design.

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	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 IN ENGINEERING & TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2022-23
B.TECH. THIRD YEAR, V SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP205TPC08	Design of Machine Elements	3	1	-	30	70	100	4
2.	IP205TPC09	Metal Cutting	3	0	-	30	70	100	3
3.	IP205TPC10	Statistical Quality Control	3	0	-	30	70	100	3
4.	IP205TPE1.	Professional Electives-01	3	0	-	30	70	100	3
5.	IP205TPE2.	Professional Electives-02	3	0	-	30	70	100	3
6.	IP205THS3.	Electives from Humanity Science-03	3	0	-	30	70	100	3
Total			**18**	**1**	**-**	**180**	**420**	**600**	**19**
PRACTICALS									
1.	IP205PPC05	Metal Cutting Lab	-	-	2	30	20	50	1
2.	IP205PSC01	Seminar	-	-	2	50	-	50	1
Total			**-**	**-**	**4**	**80**	**20**	**100**	**2**

Total Credits: **21**

Total Contact Hour: **23**

Total Marks: **700**

INTERNAL ASSESSMENT: - Two class tests of 15 marks each will be conducted.

L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP205TPE1. Professional Electives-01
IP205TPE11 Industrial Engineering
IP205TPE12 Work Study and Ergonomics
IP205TPE13 Employee Relation
IP205TPE2. Professional Electives-02
IP205TPE21 MEMS & Nanotechnology
IP205TPE22 I. C. Engine
IP205TPE23 Mechatronics
IP205THS3. Electives from Humanity Science-03
IP205THS31 Financial Management
IP205THS32 Managerial Economics
IP205THS33 Financial Accounting and Costing

Programme Outcomes:

The Students will be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1: Identify, formulate, model, design and analyse concepts to empower comprehensive knowledge allied with industrial and Production Engineering courses to the real-world applications.

PSO2:
To develop expertise in solving complex technical, industrial engineering or managerial problems related to industries through innovative solutions using technological skills, analytical aptitude, communication flair and team spirit.

PSO3: To apply theoretical and practical knowledge to solve the industrial and societal problems in the broad areas of production and industrial engineering with demonstration of leadership qualities and betterment of organization, environment and society.

B. TECH.

3rd YEAR / V SEMESTER

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPC08	Design of Machine Elements	3	1	-	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

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

COURSE CONTENT:

Module - I

Basic design concepts and design against static loading: Objective and scope of mechanical engineering design, design considerations, review and selection of materials, modes of failure, design/allowable stress, factor of safety (FoS), Design Against Fluctuating Load, theories of failure – maximum normal stress theory, maximum shear stress theory, distortion energy theory

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.

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, bolted joint under fluctuating load. Eccentrically loaded joint in shear, bolted joint with combined stresses. 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, law of gearing, 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 BOOKS:

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

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Describe the design process, material selection, calculation of stresses and selection of theory of failure.
CO2: Design the solid, hollow shafts and to finding the critical conditions and effective use of key in shaft.
CO3: Analyze riveted and bolted joints in eccentric loading
CO4: Examine the welded joints for structural applications.
CO5: Demonstrate knowledge on brakes, clutches and belt drive used in different application under static loading.
CO6: Analyze the bending and wear conditions in spur gear and knowledge to summarize the failure criteria.

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	2	1	1								2	2	3
CO2	3	3	3	2	1								2	2	3
CO3	3	2	3	3	2								1	2	3
CO4	3	2	2	2	2	3	2						1	2	3
CO5	3	2	3	3	2						2		2	3	3
CO6	3	2	3	3	2								2	3	3

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPC09	Metal Cutting	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To study the basics of metal machining and mechanics of metal machining
2. To study the different cutting tool materials and types & geometry of cutting tools
3. To learn introductory concepts of various advanced machining processes
4. To study various super finishing processes.

COURSE CONTENTS:

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

Grinding: Mechanics of grinding, cutting action, grit, Grain, Structure, Grinding Wheel Specification, Wheel Life; Balancing, Truing and Dressing of Wheels; Classifications of Abrasive Grinding Processes; wheel wear, mechanics of lapping and honing, Polishing and Buffing Chipping action in grinding,

Module - V

Unconventional Machining Processes: Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits.

Electro-chemical machining (ECM), process parameters, MRR and surface finish.

Abrasive jet machining and ultrasonic machining working principles and process parameters.

Mechanism of material removal, tooling and equipment, process parameter, surface finishing obtained by Laser beam machining (LBM) and Electron beam machining.

TEXT BOOKS

1. Metal Cutting Theory and Practice - A. Bhattachary, New Central Book Agency (P) Ltd.
2. Machining and Machine Tools - A. B. Chattopadhyay, Wiley India Publication.
3. Metal Cutting Principles - M. C. Shaw, Oxford University Press.
4. A Course in Workshop Technology, Vol II – B. S. Raghuwanshi, Dhanpat Rai & Co.
5. Production Technology - R. K. Jain, Khanna Publishers.
6. Fundamentals of Metal Machining and Machine Tools - G. Boothroyd, McGraw Hill.

COURSE OUTCOMES:

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

CO1: The students have learned the basics of metal machining

CO2: Understand and apply the principles of mechanics to metal cutting process and develop analytical relation between input and output process parameters.

CO3: Understand, analyze and apply the concept of shear deformation of materials in metal cutting.

CO4: Understand the models of the machining economics and optimization, tool wear and its measurement.

CO5: Apply the fundamentals of abrasive machining to develop theoretical relations for different types of grinding and honing operations

CO6: The students have also studied the introductory concepts of various advanced machining processes

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	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	2	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	1	-
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	2	-
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	-	-

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPC10	Statistical Quality Control	3	1	-	15	15	70	100	4

COURSE LEARNING 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, quality function deployment.

Module - IV

Introduction to ISO 9000: Various models of ISO 9000, clauses of 9000, total quality control, total quality management, tool for TQC & TQM, Kaizen, 6 sigma quality, procedure of six sigma; TQM and Six Sigma.

Module - V

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.

TEXT 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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB - TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPE11	Industrial Engineering	3	-	-	15	15	70	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, chronocyclograph, 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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB - TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPE12	Work Study and Ergonomics	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the knowledge of interaction of man, machine and integration of their tools.
2. To apply the principles of math, science, technology and engineering, involving industry-relevant problems.
3. To provide the comfort ability in working environment of all the employee, labour.
4. To apply the concept in the examination of human and work in all their contexts.

Module - I

Introduction to man machine systems and ergonomics, human factors in design and engineering, needs of ergonomics and aesthetic design, physiological aspects of work.

Module - II

Work measurement through physiological tests, work physiology, paced and unpaced work performance, data logging, data collection, data reduction and analysis techniques, gross human anatomy, anthropometry, bio mechanics, muscle strength and exertion potential of different limbs.

Module - III

Work capacity, environmental effects, exercises for evaluation of pastoral form and work spaces, environmental conditions including temperature, illumination, noise and vibration.

Module - IV

Perception and information processing, design of displays, hand control, typography, and readability, layout and composition.

Module - V

Exercises in evaluation of human response to product interface, product safety and product liability, design consideration for appearance, colour, texture and form.

TEXT BOOKS:

1. Applied Ergonomics – D. C. Alexander, Taylor & Francis.
2. Ergonomics for Beginners – Jan Dul, Taylor & Francis.
3. The Nature & Aesthetics of Design – David Pye, Cambium Press.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to design and conduct experiments, as well as to analyse and interpret data.

CO2: Ability to identify, formulate and solve engineering problems.

CO3: Ability to use the techniques, skills, and modern engineering tools necessary for work study practice.

CO4: Assess the effect of physical environment factors on comfort and performance.

CO5: Explain the influence of ergonomic principles on work organisation and culture.

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	2	-	3	2	-	-	-	-	2	3	2	2
CO2	2	3	3	2	-	2	2	-	-	-	2	2	3	2	2
CO3	3	2	2	2	-	2	3	-	-	-	2	2	2	3	2
CO4	3	2	2	2	-	2	2	-	-	-	1	2	3	2	2
CO5	3	2	2	2	-	2	2	3	-	-	-	2	2	2	3

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPE13	Employee Relations	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To develop the knowledge on trade unions and its formation, structure, functions and legal framework.
2. To gain insight into the process of collective bargaining, its origin and development.
3. To describe the activities, include annual employee reviews and the on-going development of employees through training and managerial guidance.

COURSE CONTENT:

Module - I

Conceptual framework of employment relations: Concept, scope and approaches to industrial relations, evolution of industrial relations and current developments, constitutional and legal framework of industrial relations: conventions, id act, trade union act.

Module - II

Trade unionism: Trade union development and functions, trade union structure and recognition, managing trade unions, managerial unionism, employers' organisations.

Module - III

Collective bargaining: Nature and content of collective bargaining, negotiation skills, issues and trends in collective bargaining.

Module - IV

Employee involvement: Evolution, structure and process, design and dynamics of participative forums, strategies for implementing participation.

Module - V

Grievance handling and discipline: Grievance function in industrial relations, conciliation, arbitration and adjudication, discipline in industry.

TEXT BOOKS:

1. Employee Relations Managemen t– P. N. Singh, Pearson Education India
2. Personnel Management Theory And Practice – Arun Kumar, Rachana Sharmam, Atlantic Publishers & Distribution

3. Industrial Relations and Personnel Management – A. Simon, M.V. Pylee George, Vikas Publishing House Pvt Ltd.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to describe and critique the concept of employee engagement.

CO2: Ability to identify problems associated with both over-engagement and disengagement.

CO3: Ability to examine the extent to which emotional and aesthetic labour are positioned in some contemporary organizations.

CO4: Ability to critically evaluate the measurement of employee engagement.

CO5: Ability to align organizational and employee objectives for improved organizational effectiveness.

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	3	2	3	2	2	2	2	2
CO2	-	-	-	-	-	3	3	3	3	2	3	2	3	2	3
CO3	-	-	-	-	-	2	2	3	2	3	3	2	2	3	1
CO4	-	-	-	-	-	2	2	3	2	3	2	2	3	2	2
CO5	-	-	-	-	-	1	2	3	3	2	2	1	3	2	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPE21	MEMS and Nanotechnology	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To explain students to basic concepts of nano devices and various sensors.
2. To provide knowledge about the applications of nanotechnology

COURSE CONTENT:

Module - I

Introduction of mems, micro sensor, micro actuators, microelectronic fabrications, mechanical thermal and magnetic mems, RF mems, MOEMS, mems design consideration.

Micromachining, photolithography, structural and sacrificial materials, methods of lithography. Thin film deposition, and its developments process, LPCVD, PECVD, impurity doping , etching ,problem with bulk micro machining, vapour bonding, LIGA.

Module - II

System modelling and properties of material: System types and basic modelling elements in mechanical, thermal, fluid system. Translational and rotational pure mechanical system, hybrid system, analogy between mechanical and electrical system.

Passive components and systems: System on a chip, passive electronics system, passive mechanical system.

Module - III

Mechanical sensors and actuators: Introduction, principals, micro plates, capacity impacts, piezoelectric materials, and their properties, mems gyroscope.

Thermal sensor and actuators: Introduction, thermocouple probe, micro hot plate gas sensors, mems thermo vessels, shape memory alloys.

Module - IV

Magnetic sensors and actuators: Different types and principals.

RF mems: introduction, RF based communication system, mems inductors, and tuner filter, Resonater.

Module - V

Nanotechnology: Introductions**,** nanotechnology materials, fullerenes, doping, CNT, SWCNT, MWCNT, development and application of CNT.

TEXT BOOKS:

1. MEMS - Mahalik, McGrawHill
2. MEMS & MOEMS Technology & Application - Raichoudhary, PHI.

COURSE OUTCOMES:

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

CO1: Understand the working of MEMS and NEMS

CO2: Understand the applications of nano sensors and detectors

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	1	-	-	-	-	-	-	-	2	1	1	-
CO2	3	3	2	1	-	-	-	-	-	-	-	2	1	1	-

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPE22	I. C. Engine	3	-	-	15	15	70	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, effect of variable specific heats and dissociation on indicator diagram.

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, expression for air-fuel ratio.

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

Combustion in S.I. Engines: Flame development and Propagation, ignition lag, effect of air density, temperature, engine speed, turbulence, and ignition timings, physical and chemical aspect of detonation, effect of engine and fuel variable on knocking tendency, knock rating of volatile fuels, octane number,

H.U.C.R., Action of dopes, pre-ignition, its causes and remedy, salient features of various types of combustion chambers, valve timing and firing order.

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.

Two Stroke Engine: Constructional details, scavenging parameters, models and performance of scavenging system, advantages and disadvantages of two stroke engines.

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, engine friction and lubrication, engine cooling system.

TEXT 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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205TPE23	Mechatronics	3	1	-	15	15	70	100	4

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 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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205THS31	Financial Management	3	-	-	15	15	70	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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205THS32	Managerial Economics	3	-	-	15	15	70	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		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs 1	PSOs 2	PSOs 3
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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP205THS33	Financial Accounting and Costing	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To ascertain the cost per unit of the different products manufactured by a business concern.
2. To provide a correct analysis of cost both by process or operations and by different elements of cost.
3. To disclose sources of wastage whether of material, time or expense or in the use of machinery.
4. Equipment and tools and to prepare such reports which may be necessary to control such wastage.
5. To provide requisite data and serve as a guide for fixing prices of products manufactured or services rendered.

COURSE CONTENT:

Module - I

Financial accounting: Introduction to book keeping, double-entry accounting, journal & ledger posting, financial statements &analysis, trial balance, preparation of trading and profit & loss account and balance sheet.

Module - II

Ratio analysis: Balance sheet ratios, current ratio, fixed asset ratio, liquidity ratio, capital gearing ratio, profit-loss account ratios, gross margin ratio, net margin ratio, combined ratios, return on investment ratio, net profit to total assets ratio, creditors turnover ratio.

Module - III

Costing: Objectives of costing, elements of costing, methods of costing, preparation of cost sheet, job costing, marginal costing, absorption costing, process costing and standard costing-material, labour, overhead cost variance, activity based costing and target costing, cost-profit-volume analysis and problems on cost-volume-profit analysis.

Module - IV

Working capital management: Introduction, concepts of working capital, operating and cash conversion cycle, permanent and variable working capital, balanced working capital position, determinants of working capital, estimating working capital needs, policies for financing current assets, issues in working capital management.

Module - V

Capital budgeting: Nature and scope of capital budgeting, features of capital budgeting, methods of capital budgeting, DCF, NON-DCF techniques, accounting rate of return, net present value, payback period, discounted payback period, profitability index.

TEXT BOOKS:

1. Accounting for Management – T. Vijaya Kumar, 1/e, Tata McGraw-Hill.
2. Financial Management – I. M. Pandey9/e, Vikas Publishing House.
3. Cost Accounting – M.Y. Khan and P. K. Jain, 2/e, TMH.
4. Management Accounting – M.Y. Khan and P. K. Jain, Text, Problems and Cases, 6/e TMH.
5. Basic Financial Management – M.Y. Khan, P. K. Jain, 3/e, TMH.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Appreciate the need for negotiable instruments and procedure of accounting for bills honoured and dishonoured.

CO2: Differentiate trade bills from accommodation bills.

CO3: Understand the concept of consignment and learn the accounting treatment of the various aspects of consignment.

CO4: Distinguish joint venture and partnership and to learn the methods of maintaining records under joint venture.

CO5: Distinguish between single entry and double entry.

CO6: Know the ascertainment of profit under single entry system.

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	1	-	-
CO2	-	-	-	-	-	-	-	-	1	1	3	2	1	-	-
CO3	-	-	-	-	-	-	-	-	2	2	3	2	1	-	-
CO4	-	-	-	-	-	-	-	-	2	2	2	3	1	-	-
CO5	-	-	-	-	-	-	-	-	-	-	3	2	1	-	-
CO6	-	-	-	-	-	-	-	-	1	2	3	2	1	-	-

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech. V Sem.	IP205PPC05	Metal Cutting Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Operate machine tool equipment commonly found in industry like lath machine, milling machine and grinding machine.
2. Manufacture parts from various materials in accordance with sp blueprints, electronic drawings and shop sketches.
3. Apply safety principles in a work environment to minimize hazards a to productivity.

LIST OF EXPERIMENTS:

1. Introduction of general purpose machine lath and drilling machine, shaping machine, milling and grinding 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 surface grinding operation.
6. Thread cutting and knurling on lathe machine.
7. To verify the Merchant's force diagram.

COURSE OUTCOMES:

After completion of the course, student 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.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech. V Sem.	IP205PSC01	SEMINAR	-	-	2	50	-	50	1

COURSE OBJECTIVES:

1. To increase the self-confidence among students which helps in finding their own proficiency
2. To cultivate student's leadership ability and responsibility to perform and execute the given task.
3. To provide learners hands on practice within a real job situation.
4. Enhance and supplement the knowledge and skills of the students.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the role of self-efficacy, personal goals, and motivation in improving academic life.

CO2: Describe the behaviours and characteristics of an effective learner.

CO3: Ability to identify, formulate and model problems and find engineering solution based on a systems approach.

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2022-23
B. TECH THIRD YEAR, VI SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP206TPC11	Operation Research	3	1	0	30	70	100	4
2.	IP206TPC12	Metrology & Measurement	3	0	0	30	70	100	3
3.	IP206TPC13	Welding Engineering	3	0	0	30	70	100	3
4.	IP206TPE3.	Professional Elective-03	3	0	0	30	70	100	3
5.	IP206TPE4.	Professional Elective-04	3	0	0	30	70	100	3
6	IP206TOE01	Open Elective-01	3	0	0	30	70	100	3
		Total	**18**	**1**	**0**	**180**	**420**	**600**	**19**
PRACTICALS									
1.	IP206PPC06	Metrology & Measurement Lab	0	0	2	30	20	50	1
2.	IP206PPC07	Welding Engineering Lab	0	0	2	30	20	50	1
		Total	**-**	**-**	**4**	**60**	**40**	**100**	**2**

Total Credits: **21** Total Contact Hour: **23** Total Marks: **700**

INTERNAL ASSESSMENT: - Two class tests of 15 marks each will be conducted.

L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP206TPE3. Professional Electives-03	
IP206TPE31 Material Management	
IP206TPE32 Plant Layout& Material Handling	
IP206TPE33 Maintenance & Reliability Engineering	
IP206TPE4. Professional Electives-04	
IP206TPE41 Automobile Engineering	
IP206TPE42 Power Plant Engineering	
IP206TPE43 Heat & Mass Transfer	
IP206TOE1. Open Elective-01	Offering department
CH206TOE01 Industrial utilities and safety	Chemical
CE206TOE01 Metro systems and Engineering	Civil
CS206TOE01 Object Oriented Programming with C++	CSE
EC206TOE01 Introduction to electronic devices and circuits	ECE
IT206TOE01 Computer Graphics	IT
ME206TOE01 Automobile Engineering	MECH
IP206TOE01 Operation Research as open elective for departments- Chemical, Civil, CSE, ECE, IT & MECH	

Department of Industrial & Production Engineering
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
B.Tech In Industrial and Production Engineering
Final Year (VI Semester)

Programme Outcomes:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1: Identify, formulate, model, design and analyse concepts to empower comprehensive knowledge allied with industrial and Production Engineering courses to the real-world applications.

PSO2: To develop expertise in solving complex technical, industrial engineering or managerial problems related to industries through innovative solutions using technological skills, analytical aptitude, communication flair and team spirit.

PSO3: To apply theoretical and practical knowledge to solve the industrial and societal problems in the broad areas of production and industrial engineering with demonstration of leadership qualities and betterment of organization, environment and society.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPC11	Operation Research	3	1	-	15	15	70	100	4

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: Graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, maximization & minimization function with or without constraints, sack surplus & artificial, variable method, degeneracy problem.

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, traveling 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 3game (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.

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.

TEXT & REFERENCE BOOKS:

1. Operation ReasearchSharma & 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	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPC12	Metrology& Measurement	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To under standard, 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 familiar 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, acceleration, online measurement and micro-nano measurements.

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, Wear allowance on gauges

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

Types of machine tool tests, alignment tests for lathe, milling and drilling machine tools

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, Wheatstone bridge circuit

Vibration and Noise Measurement: Piezoelectric Accelerometer and decibel meters concept of on-line inspection & Micro-nano Measurement tools.

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:

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.

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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPC13	Welding Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To impart knowledge about welding behaviour of machine and process during welding, analysis of common and newer welding techniques and metallurgical and weldability aspects of different common engineering materials.
2. To impart knowledge on various advanced welding processes so that the students can apply them in engineering industry applications.
3. To develop the knowledge on the design of welded joints and the quality control of weldment.

COURSE CONTENTS

Module - I

Welding: Classifications, principle and equipments of gas welding and Arc Welding, different type of welding process and their equipments, 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 - II

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 - III

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.

Module- IV

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

Brazing, Soldering and their Application: Hydrogen Induced Cracking.

Module - V

Design of Weldment: Weld Geometry, Eccentric Loading Designing Torsion and bending, Designing welding fixtures.

Testing, Inspection and Specification: Destructive and Non-destructive methods of testing weldment, WPS, PQR, and ASME section IX Welding.

Robotics and Automation in Welding: Modes of Automation, Positioners, Welding Fixtures, and Arc Motion Devices, Under Water Welding'

TEXT & REFERENCE BOOKS:

1. Modern Arc Welding Technology - S.V. Nadkarni, Oxford IBH Publishers.
2. Welding and Welding Technology- R.L. Little, Tata McGraw-Hill.
3. Welding Technology - O.P, Khanna Dhanpat Rai & Sons.
4. Welding Processes & Technology-R.S. Parmar, Khanna Publishers.
5. Manufacturing Technology (Foundry, Forming and Welding Vol. 1) - P. N. Rao, Tata McGraw Hill.

COURSE OUTCOMES:

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

CO1: The difference between various welding processes and its industrial utilization

CO2: Apply the knowledge of solid state welding process for engineering applications.

CO3: Understand the principles of radiant energy metal joining process.

CO4: Understand the fundamental principles of special arc welding process

CO5: Understand the knowledge of plasma arc in metal joining and cutting process

CO6: Understand the knowledge of design principles in weld joints. Apply the concept of quality control 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	2	2	1	2	2	-	-	-	-	2	3	2	2
CO2	3	2	2	2	1	1	1	-	-	-	-	2	2	2	1
CO3	3	2	1	2	1	2	2	-	-	-	-	2	2	2	2
CO4	3	2	2	2	1	2	1	-	-	-	-	2	2	1	2
CO5	3	2	2	1	1	1	1	-	-	-	-	1	2	1	1
CO6	3	2	2	2	1	2	1	-	-	-	-	3	3	1	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPE31	Material Management	3	-	-	15	15	70	100	3

COURSE LEARNING 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.

Syllabus Content:

Module – I

Introduction: Definition and scope, 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, relevant costs 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: Value importance, normal degree value analysis applied to purchase, organizing for value analysis, cost analysis and value analysis aid purchase research, material and process selection in VE design, material, process and supplier decisions.

TEXT & REFERENCE BOOKS:

1.Materials Management an integrated approach – P. Gopal Krishnan. & 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: Shall be able to manage the activities of materials manager like purchasing, inventory analysis, storage etc.in a scientific manner.
CO3: Shall be able to improve due date performance through use of MRP techniques with in capacity constraints.
CO4: Shall be able to practice material planning through modern materials management tools like JIT, DBR etc.
CO5: Understand ethical issues in purchasing and negotiations

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	2	2	1				3		2	1	2	1	3
CO2	3	3	2	2	3								2	2	3
CO3	3	2	2	2	3								1	2	3
CO4	3	2	2	2	3								2	1	3
CO5	3	2	2	1	1			3					2	2	3

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPE32	Plant Layout& Material Handling	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

1. To provide the basic concepts related to the interactions between the production system parameters and their impact on materials handling systems design.
2. To familiarize students with different methods available for the generation of plant layouts.
3. To provide students with information on materials handling systems design for various aspects of the manufacturing and service industry.

COURSE CONTENT:

Module - I

Plant facility locating: Concept of plant facility**,** its scope, importance and objectives nature of location decision, need for facility location planning, general procedures and factors influencing location decision, facility location models, economics and cost analysis, rural and urban location pattern in India.

Module - II

Layout designs: Industrial plant design consideration, types of production types of layout, factors affecting layout tools, techniques and procedure used in workstation and plant layout, quantitative technique in plant layout, developing product and process layout, comparing layouts, criteria for computerized facility layout, concept of computerized layout programs like CRAFT, CORELAP, ALDEP and PLANET.

Module - III

Flow pattern design: Overall system flow cycle, need and advantage of planned material flow, factors for consideration, designing flow pattern, flow patterns for production lines and assembly lines methods.

Module - IV

Material Handling: Scope and functions of material handling, manual mechanical handling ratio, principles of material handling, analysis of material handling problem, classification of material handling system, salient features and application of general purpose material handling equipment, material handling in stores and warehouses, automation in part handling and industrial robots, optimum allocation of material handling equipment.

Module - V

Automated material handling system: Concept of AGVs, AR/RS and methods to minimize cost of material handling, safety in material handling, evaluation of material handling process, design procedure of cranes, lifts.

TEXT & REFERENCE BOOKS:

1. Practical plant layout - Muther
2. Plant layout and design - James More
3. Manufacturing Management: A Quantitative approach - Robert Aolsem
4. Productions and Operation Management - Lockyer.

COURSE OUTCOMES:

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

CO1: To describe and determine the effect of product, process, and schedule design parameters on plant layout and materials handling systems design.

CO2: To identify the characteristics of product and process layouts and their needs in terms of materials handling.

CO3: To develop and analyze plant layouts using manual and computer aided software methodologies.

CO4: To identify and select various types of material handling equipment.

CO5: To design material handling systems for a variety of scenarios pertaining to manufacturing and service 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	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	1	-	-	-	-	-	1	3	1	3
CO2	3	2	2	1	1	-	-	-	-	-	-	1	3	1	3
CO3	3	2	2	3	-	-	-	-	-	-	-	1	3	2	3
CO4	3	3	2	3	-	-	-	-	-	-	-	1	3	2	3
CO5	3	3	1	2	1	-	-	-	-	-	-	1	3	3	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPE33	Maintenance & Reliability Engineering	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

1. To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2. To provide the concept of various types of maintenance system used in industries.
3. To impart knowledge on reasons for failure and the corrective and preventive measure adopted to reduce them.
4. To make the students to be familiar with the concept of reliability engineering
5. To make the students to understand the various maintenance and logistics means or the execution of various services.
6. To impart knowledge on creating various tools for maintainability of mechanical system.

COURSE CONTENT:

Module-I

Concept of reliability: Objectives, applications, area of use, use of reliability in industry, reliability functions, mean time between failures, hazard rate function, bath tub curve, conditional reliability, probability density function, failure rate, failure density, hazard rate, uncertainty measures.

Module - II

Constant and time dependent failure models: Exponential, Webull, normal and lognormal distributions, discrete distribution, binomial distribution, Poission distribution.

Reliability of systems: Series, parallel, mixed connected systems, K-out –of –M system concept of redundancy, objectives, applications, redundant standby systems, system structure functions, minimal cuts and minimal paths, common mode failures, three state devices.

Module – III

Determination of reliability (state dependent systems): Markov analysis, load sharing system, standby systems, degraded systems.

Failure analysis: Introduction to failure mode and effect analysis, FMEA and FMECA, criticality analysis, fault tree diagram, event tree.

Availability: Concept and definitions, types of availability model, system availability.

Module- IV

Introduction: Objectives and policies of maintenance, maintainability terms and definitions, maintainability organization functions and tasks, estimation of maintenance cost.

Types of maintenance: Breakdown, predictive, replacement, on-line, off-line, preventive maintenance, reconditioning and correction maintenance, preventive maintenances v/s. repair, reliability centered maintenance, condition-based maintenance, principals and level of CBM.

Module-V

Total productive maintenance: Goals objective benefits of TPM, component of TPM, calculation of OEE, training for maintenance personal, objective and level of training, types of training methodology, evaluation of maintenance department.

TEXT & REFERENCE BOOKS:

1. Principles of Planned Maintenance – R. H Clifton, McGraw Hill Publications.
2. An introduction to Reliability and Maintainability Engineering – C.E Ebling, Tata McGraw Hill.
3. Reliability Engineering - L. S Srinath, Affiliated East-West Press Limited, New Delhi.
4. Engineering Maintainability – B. S Dhillon Prentice Hall of India, New Delhi.
5. Maintainace and spare parts management - P. Gopalkrishnan, PHI.

COURSE OUTCOMES:

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

CO1: Analyse the reliability of different types of equipment/machines and products.
CO2: Apply the tools and techniques of reliability and maintainability
CO3 :Estimate the root cause analysis and maintenance costs of different machines
CO4: Plan for risk assessment for condition monitoring
CO5: Analyse failure mode effect analysis of different machines and products.

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	2	1	2	-	-	-	2	1	-	1	1	1	3
CO2	3	2	3	-	2	1	1	-	2	2	-	2	2	2	3
CO3	2	3	3	2	2	2	2	1	2	2	2	-	3	1	3
CO4	2	3	2	3	2	-	1	-	1	2	1	1	2	1	3
CO5	3	2	3	1	3	2	2	1	2	3	2	2	3	2	3

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPE41	Automobile Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the knowledge of basic structure of an automobile.
2. To provide the knowledge of transmission system and its various elements.
3. To provide the knowledge of clutches and suspension system
4. To provide the knowledge of braking system.
5. To provide the knowledge of steering system and engine emissions.

COURSE CONTENT:

Module - I

Introduction of an automobile: Component and basis structure of automobile, classification, difference between automobile and automotive, the chassis construction & classification, defect in frames, frameless construction & specifications. Wheel and tyres: Types of wheel, wheel dimension, desirable tyres properties, types of tyres, tyre material, tyre dimension, factors affecting tyre life.

Module - II

Transmission system: Function of transmission types, sliding mesh gear box, constant mesh gear box, synchro mesh gear box, torque converter, propeller shaft, universal joint, hook joint, final drive, differential, performance of gear box.

Module - III

Clutches: Requirement, function & type of clutch, dry friction clutch, wet friction clutch, clutch plate, single plate & multiple plate clutch, centrifugal clutch and fluid fly wheel.

Suspension system function and requirement, leaf spring, torsion bar, telescopic shock absorber.

Module - IV

Brakes: Function and requirement, brake efficiency, wheel skidding, types of brake, electrical, mechanical and hydraulic & pneumatic brakes, master cylinder, wheel cylinder, self-actualizing brakes, brake drum, brake liners, brake shoe, trouble shooting.

Module - V

Front axle and suspension wheel alignment purpose: Factor of front wheel alignment, steering geometry, correct steering angle, steering mechanism, under steer and over steer, steering gear, power steering, reversibility of steering gears, steering gear ratio, calculation of turning radius.

Engine emission: Emission standard of vehicle in India, Euro norms, emission, testing. Principle of multipoint fuel injection (MPFI), component of MPFI, different sensors of MPFI system, vehicle air conditioning.

TEXT & REFERENCE BOOKS:

1. Automobile Engineering - Kripal Singh Vol. I, II.
2. Automobile Mechanics - Joseph Heitner.
3. Automobile Engineering - N.K Giri
4. Automobile Engineering - Shrinivasan T.M.H.
5. Automobile Engineering - K.K. Jain, R.B. Asthana T.M.H.
6. Automobile Engineering - R.B. Gupta Tech India Publication Series.

COURSE OUTCOMES:

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

CO1: Graduates will gain a strong foundation in core automobile engineering, both in theoretical and applied concepts.

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

CO3: Graduates will develop an ability to identify and solve automobile engineering maintenance 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	3	1	1	1	-	-	-	-	-	-	-	1	3	1	1
CO2	3	3	3	3	2	1	-	-	-	-	-	2	3	1	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	3	1	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPE42	Power Plant Engineering	3	-	-	15	15	70	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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP206TPE43	Heat & Mass Transfer	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

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 and the principles of mass transfer.

COURSE CONTENT:

Module-I

Introduction: 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.

Conduction: Thermal conductivity of solids, liquids and gases, factors in influencing conductivity measurement, general differential equation of conduction, one dimensional steady state conduction, linear heat flow through a plane and composite wall, tube and sphere, critical thickness of insulation, conduction with heat generation in flat and cylinders.

Module-II

Fins: Conduction convection system, extended surfaces rectangular, triangular circumferential and pin fins, general conduction analysis, fins of uniforms cross section area, heat dissipated by a fin, effectiveness and efficiency of fin.

Transient (Unsteady state) heat conduction: Transient conduction in solids with infinite thermal conductivity, Transient conduction in solids with finite conduction and convective resistance.

Module-III

Forced Convection: Physical mechanism of forced convection, dimensional analysis for forced convection, velocity and thermal boundary layer, flow over plates, flow across cylinders and flow in tube, Reynolds analogy.

Natural Convection: Physical mechanism of natural convection, dimensional analysis of natural convection, empirical relationship for natural convection.

Module-IV

Boiling and Condensation: Boiling heat transfer, pool boiling, condensation heat transfer, film condensation.

Heat Exchangers: Different type of heat exchanger, determination of heat exchanger performance, heat exchanger transfer Module, analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method).

Module-V

Thermal Radiation: Introduction, absorption and reflection of radiant energy, emission, radiosity and irradiation, black and non-black bodies, Kirchhoff's law, intensity of radiation, radiation exchange between black surface, geometric configuration factors.

Introduction to Mass Transfer: Mass transfer processes: classification, concentrations, velocities and fluxes, molecular diffusion, eddy diffusion, convective mass transfer.

TEXT & REFERENCE BOOKS:

1. Heat transfer -S.P. Sukhatme, TMH.
2. Heat & Mass Transfer- P K Nag, TMH Publications.
3. Fundamentals of Heat and Mass Transfer - Frank P. Incropera, David P. Dewitt, Wiley.
4. Heat & Mass Transfer - Arora and Domkundwar, Dhanpat Rai Publications.
5. Heat Transfer-C.P. Arora, TMH.
6. Heat & Mass Transfer- R.C. Sachdeva, New AgePublications.
7. Heat Transfer- J.P. Holman, TMH.
8. Heat Transfer : A Practical Approach- Yunus A. Cengel, TMH Publications.
9. Heat & Mass Transfer Book – C P Kothandaraman S Subramanyan, New Age International Publishers.

COURSE OUTCOMES:

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

CO1: Classify and differentiate between various modes of heat transfer.

CO2: Design an extended surface for enhancing heat transfer for any device/equipment.

CO3: Calculate heat transfer through any substance for both steady and unsteady state conditions.

CO4: Identify the type of convection process and calculate heat transfer in any real time given situation.

CO5: Design an improved heat exchanger to maximize the heat transfer efficiently.

CO6: Explain the radiation heat transfer phenomenon and apply the knowledge to design a new engineering device.

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	PSOs2	PSOs3
CO1	3	2	1	1	-	-	-	-	-	-	-	2	3	2	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	3	2	1
CO3	3	3	3	2	2	-	-	-	-	-	-	2	3	1	1
CO4	3	3	3	2	2	-	-	-	-	-	-	2	3	2	1
CO5	3	3	3	3	1	-	-	-	-	-	-	2	3	1	1
CO5	3	2	3	3	1	-	-	-	-	-	-	3	3	2	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech VI Sem.	IP206PPC06	Measurement & Metrology Lab	-	-	2	30	20	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 EXPERIMENTS:

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).

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	3	3	2	2	-	-	2	-	2	2	3	2	3

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech VI Sem.	IP206PPC07	Welding Engineering Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Availability of various manual and automated welding processes.
2. To provide information related to concepts, operating procedures of various welding processes.
3. To gain knowledge on practical aspects of different welding processes and apply effectively on various engineering applications.

COURSE OUTCOMES:

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

CO1: To acquire the knowledge and skills of modern welding techniques.

CO2: To develop the skills of conventional welding techniques.

CO3: To have a practical exposer various testing methods of welding joint.

LIST OF EXPERIMENTS:

1. To make a Lap joint, using the given two M.S pieces by arc welding.
2. To make a corner joint, using the given two M.S pieces by arc welding.
3. To prepare a butt joint with mild steel strips using brazing technique.
4. To prepare a butt joint with mild steel strip using GMAW technique.
5. To study and observe the welding and brazing techniques through demonstration and practice (Gas, MIG, TIG, Brazing).

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	-	-	-	-	-	-	2	1	1	1
CO2	3	2	2	1	1	-	-	-	-	-	-	2	1	2	2
CO3	3	2	2	1	1	-	-	-	-	-	-	2	1	1	1

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

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2023-24
B. TECH FOURTH YEAR, VII SEMESTER

S. No	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP207TPC14	Computer Aided Design & Manufacturing	3	1	-	30	70	100	4
2.	IP207TPE05	Production Planning and Control	3	-	-	30	70	100	3
3.	IP207TPE6.	Professional Elective-05	3	-	-	30	70	100	3
4.	IP207TOE2.	Open Elective-02	3	-	-	30	70	100	3
5.	IP207TOE3.	Open Elective-03	3	-	-	30	70	100	3
6.	IP207TMC02	Environmental Sciences	3	-	-	-	-	-	-
Total			**18**	**1**	**-**	**150**	**350**	**500**	**16**
PRACTICALS									
1.	IP207PPC08	CAD/CAM Lab	-	-	2	30	20	50	1
2.	IP207PSC02	Seminar on Summer Training	-	-	4	50	-	50	2
3	IP207PPR01	Minor Project	-	-	8	100	-	100	4
Total			**-**	**-**	**14**	**180**	**20**	**200**	**7**

Total Credits: **23**
Total Contact Hour: **33**
Total Marks: 7**00**
INTERNAL ASSESSMENT: two class tests of 15 marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP207TPE6. Professional Electives-05
IP207TPE61 Fundamentals of Green Manufacturing
IP207TPE62 Product Design & Development
IP207TPE63 Engineering Economics
IP207TOE2. Open Elective-02
IP207TOE21 Computer Aided Process Planning (CAPP)
IP207TOE22 Principles of Management
IP207TOE23 Maintenance Management
IP207TOE3. Open Elective-03
IP207TOE31 Advanced Manufacturing Processes
IP207TOE32 Turbo Machinery
IP207TOE33 Strategic Management

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPC14	Computer Aided Design & Manufacturing	3	1	-	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To introduce the student to be familiar with CAD/CAM terminology and its capabilities.
- To recognize geometric and graphical elements of engineering design problems.
- To study Basic features of CAM so as to be capable of accepting professional responsibilities and to understand the associativity between design and manufacturing.
- Integrate the CAD system and the CAM system by using the CAD system for modelling design information and converting the CAD model into a CAM model for modelling the manufacturing information.

COURSE CONTENT:

MODULE-I

Basics of CAD: Basics fundamental of computer graphics, principle of computer graphics, product life cycle, concept of computer aided design (CAD) and architecture, hardware and software, color management, raster graphics, graphic primitives, lines, and circle drawing algorithms, software documentations, CAD standards GKS, openGL, data exchange standards: IGES, STEP, CALS etc., communication standards, standards for exchange images.

MODULE - II

Geometric modeling of curves, surface and solid: Basics representation of curves, parametric and non- parametric curves, mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves, basic of surface, techniques of surface modeling, plane surface, rule surface, surface of revolution and sweep, coons and bi-cubic patches, concept of Bezier and B-spline surfaces, basic concept of solid modeling technique, CSG and B-rep method for solid generation.

MODULE – III

Geometric transformation: Computer Aided Design (CAD) methodology, coordinate systems, theory and applications, 2D and 3D geometric transformation, homogeneous transformation, concatenation, assembly modeling, interferences of positions and orientation, tolerance analysis, mass property calculations, visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, concurrent engineering.

MODULE – IV

Basics of CAM: Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, application of NC, concepts of computer numeric control (CNC) system, problems with conventional, NC, CNC.

Part Programming: Introduction to NC part programming, manual part programming, computer assisted part programming, automatically programming tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

MODULE - V

Advance manufacturing system: Concept of distributed numeric control (DNC) system, and its advantages and disadvantages of over NC and CNC, Concept of computer integrated method (CIM), Flexible manufacturing system(FMS), benefits and applications of CIM and FMS, group technology(GT), parts classification and coding systems, benefits and applications of GT, automated storage and retrieval system (AS/RS), automated guided vehicle (AGV).

COURSE OUTCOMES:

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

CO1: Understand the various CAD/CAM and CNC processes.

CO2: Recognize various types of Curves, surface and Solid and their application as used in geometric modelling.

CO3: Analyse the NC programs to generate and verify the tool path for milling and drilling manufacturing processes.

CO4: Appreciate the concept of parametric modelling which is the mainstay of most of the 3D modelling system.

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 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	-	2	-	-	-	-	-	-	2	3	3	1
CO2	3	3	2	1	2	-	-	-	-	-	-	2	3	3	1
CO3	3	3	1	3	2	-	-	-	-	-	-	2	3	3	3
CO4	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE05	Production Planning and Control	3	-	-	15	15	70	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 a 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: 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, weighted average, trend, seasonality, regression technique, delphi method.

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, limitations.

Capacity requirement planning: Definition, objectives, process of CRP, process sheet, rough cut capacity planning, loading, and preparation of CRP chart.

MODULE – III

Scheduling: Types, single machine scheduling, job shop scheduling, flow scheduling;

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, 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.

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.

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 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

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE61	Fundamentals of Green Manufacturing	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

1. To develop the basic concepts of the three pillars of sustainability and how they are manifested in sustainable and green manufacturing as well as to facilitate the students to presume position of scientific and/or managerial leadership in their career paths towards green manufacturing.
2. To help students to develop the basics of the green manufacturing concepts, strategy, different technology used to implement green manufacturing.
3. To develop the basic concepts of Life Cycle Assessment approach to evaluate environmental impacts of product design, manufacturing processes, product use-phase, and product end-of-life.
4. To broaden and deepen their capabilities and understanding towards concepts of different types of green technology.
5. To help students to develop the basic understanding on lean and green technology and differences and similarities between both.

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 labellingtarget 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.

COURSE OUTCOMES:

Upon completion of the course students will be able to

CO1-Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

CO2-Graduate will become familiar with green manufacturing concepts and practices and analyze the problems within the domains of Green Manufacturing as the members of multidisciplinary teams. As well will be able to formulate appropriate green manufacturing strategy.

CO3-Graduate will be trained towards the basic concepts of Life Cycle Assessment approach to evaluate environmental impacts of product design, manufacturing processes, product use-phase, and product end-of-life.

CO4-Formulate and apply different green technologies as per the requirement and situations and able to plan good housekeeping practices for Industry/other places with concern of safety, hygiene and waste reduction.

CO5- Apply different approaches of lean and green manufacturing in the real world problem to overcome the problems arises due to manufacturing.

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.

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

COs	POs												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSOs 1	PSOs 2	PSOs 3
CO 1	-	2	3	2	1	2	3	1	1	2	2	1	3	2	2
CO 2	-	2	3	2	1	3	3	1	1	2	3	2	3	2	2
CO 3	-	2	3	2	1	2	3	2	1	3	3	2	3	3	3
CO 4	-	2	3	2	2	3	3	1	1	3	2	2	3	2	2
CO 5	-	2	3	2	1	3	3	1	1	2	2	1	3	2	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE62	Product Design & Development	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To introduce design concepts and techniques to develop design ability in a product design.
- To provide knowledge about estimating and evaluating the feasible manufacturing design.
- To make aware of legal issues pertaining to product design.
- 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.

COURSE OUTCOMES:

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

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

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

CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	2	3	1	1	-	-	2	3	1	1	1	2	2	2
CO 2	3	2	2	1	1	-	-	2	2	2	2	2	3	2	2
CO 3	3	2	2	2	1	2	3	2	2	2	2	2	2	3	2
CO 4	1	2	2	-	1	2	2	2	2	2	1	1	1	1	1
CO 5	1	-	1	2	-	1	1	2	2	2	1	1	1	2	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TPE63	Engineering Economics	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

1. To understand the basic economic principle as a consumer in an economy
2. To be able to know the utility measurement in the presence of risk and uncertainty
3. To prepare the Engineering students to learn about the production process and analyse the cost/revenue data.
4. To provide the foundation for engineers to make good decisions in business environment and learn about the market mechanism.
5. To be able to make decision on project alternatives and justify 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.

COURSE OUTCOMES:

Upon completion of the course students will be able to

COURSE OUTCOMES:

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

1. **CO1-**Utilise economics principles in consumption process
2. **CO2-**Describe the utility measurement and measure the utility associated with risk
3. **CO3-**Efficient use of resources in production and take decision regarding optimum output
4. **CO4-**Describe market mechanism and analyse product market to take proper decisions
5. **CO5-**Implement economic principles in company related decision making.

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.

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)

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TOE21	Computer Aided Process Planning (CAPP)	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

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

Syllabus 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

COURSE OUTCOMES:

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

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

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 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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TOE22	**Principles of Management**	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

The objectives of this course are:

- To understand the basic concept of the functions and responsibilities of managers.
- To learn the nature and purpose of planning.
- To understand the nature and purpose of organizingthe environment of the organization.
- To learn the leadership qualities and the methods of directing for effective communication.
- To learn the different methods of controlling the management activities.

COURSE CONTENT:

MODULE - I

Introduction: Definition of management, science or art, manager v/s entrepreneur, types of managers managerial roles and skills, evolution of management- scientific, human relations, system and contingency approaches, types of business organizations, sole proprietorship, partnership, company, public and private enterprises, organization culture and environment, current trends and issues in 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

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.

Course Outcomes and their mapping with Program Outcomes:

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

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TOE23	Maintenance Management	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

CLO1-To develop the skill of maintenance functions in industry.

CLO2-To provide the concept of various types of maintenance system used in industries.

CLO3-To impart knowledge on reasons for failure and the corrective and preventive measure adopted to reduce them.

CLO4-To create the ability of data, analyze failure cause and reliability engineering.

CLO5 -To develop the new techniques of maintenance for minimizing the cost of maintenance and improving of life of equipment's.

COURSE CONTENT:

MODULE - I

Introduction: Fundamentals of maintenance engineering, maintenance engineering its importance in material & energy conservation, inventory control, productivity, safety, pollution control etc. safety regulations, pollution problems, human reliability, total quality management (TQM), total productivity maintenance (TPM), environmental issues in maintenance, ISO 9000.

MODULE - II

Maintenance management: Types of maintenance strategies, Planned and unplanned maintenance, breakdown, preventive & predictive maintenance and their comparison, advantages & disadvantages, limitations of computer aided maintenance, maintenance scheduling, spare part management, inventory control, organization of maintenance department.

MODULE - III

Tribology in maintenance: Friction wear and lubrication, friction & wear mechanisms, prevention of wear, types of lubrication mechanisms, lubrication processes.

Lubricants: Types, general and special purpose, additives, testing of lubricants, degradation of lubricants, seal & packing.

MODULE - IV

Machine health monitoring: Condition based maintenance, signature analysis, oil analysis, vibration, noise and thermal signatures, on line & off line techniques, instrumentation & equipment used in machine health monitoring. instrumentation in maintenance, signal processing, data acquisition and analysis, application of intelligent systems, data base design.

TPM: Introduction, history, components, pillars of TPM, calculation of OEE, Terri technology.

MODULE - V

Reliability, availability & maintainability (RAM) analysis: Introduction to RAM failure mechanism, failure data analysis, failure distribution, reliability of repairable and non-repairable systems, improvement in reliability, reliability testing, reliability prediction, utilization factor, system reliability by Monte Carlo simulation technique, FMECA.

COURSE OUTCOMES:

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

CO1-Understand and be able to **Develop** effective maintenance strategy and continuously improve maintenance systems.

CO2-. **Organize & compare** planned maintenance programs

CO3- Identify plant's reliability problems and provide solutions to it.

CO4-.Examine the execution of maintenance and reliability programs.

CO5-Identify maintenance capacity planning issues and compile required resources for effective and efficient maintenance.

TEXT & REFERENCE BOOKS:

1. Maintenance Engineering Hand Book, Higgins.
2. Maintenance & Spare parts Management, Gopal Krishnan.
3. Industrial Maintenance Management, S.K. Shrivastava.

Industrial Engineering, Hand book of Condition Monitoring, C

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	-	2	-	-	-	1	2	3	3	3	2
CO2	3	3	3	3	-	2	-	-	-	-	-	3	3	3	2
CO3	3	3	3	3	-	2	3	-	-	1	-	3	3	3	2

CO4	3	3	3	-	-	2	2	1	1	3	-	3	3	3	2
CO5	3	3	3	3	-	1	2	1	2	3	2	3	2	2	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TOE31	Advanced Manufacturing Processes	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the principle of various advanced machining processes kinematics drive of machine tool.
- To impart knowledge about cutting different material removal, joining processes.
- To understand about various advanced metal forming processes.
- Explain how to identify suitable hybrid welding processes for joining dissimilar materials.
- To understand about various advanced casting processes.

COURSE CONTENT:

MODULE – I

Advanced machining processes: 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 – II

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, mechanics of grinding, dynamometry, thermal aspects of machining, tool wear, economics of machining, processing of polymers, ceramics, and composites.

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.

COURSE OUTCOMES:

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

- Basic understanding of advanced casting processes and able to analyze real-life application in various organizations.
- Categorize different material removal, joining processes as per the requirements of material being used to manufacture end product.
- Choose material processing technique with the aim of cost reduction, reducing material wastage & machining time.
- Estimate process parameters affecting the product quality in various advanced machining of metals/ non-metals, ceramics and composites.
- Evaluation and Analysis of the different advanced welding process to select most suitable welding procedure and consumables for a product.

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.

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	-	2	2	2	-	1	1	2	1	2	2
CO2	2	2	2	1	1	-	-	1	1	1	1	2	1	2	2
CO3	1	2	2	2	1	1	2	1	2	1	1	2	2	2	2
CO4	2	3	3	3	1	-	-	2	-	1	1	2	2	2	2
CO5	2	2	2	3	2	1	1	2	-	2	1	2	1	2	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TOE32	Turbo Machinery	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To study classifications of turbo-machines.
- To study construction and working of different turbo- machines.
- To acquire the knowledge and skill of analyzing different turbo- machines.

COURSE CONTENT:

UNIT- I

Nozzles & Diffuser: Nozzles & Diffuser types, their efficiency, critical pressure & velocity, relationship between area, velocity & pressure in nozzles flow. Steam Turbine Types: Steam turbine-principal of operation of steam turbine, types, impulse turbine, compounding of steam turbine pressure compounded velocity compounded and pressure- velocity compounded impulse turbine. Velocity diagram for impulse turbine: force on the blade and work done, blade or diagram efficiency, gross stage efficiency, influence of ration of blade to steam speed on blade efficiency in a single stage impulse turbine, impulse blade section, choice of blade angle.

UNIT – II

Impulse-reaction turbine: Velocity diagram, degree of reaction, Impulse-Reaction turbines with similar blade section and half degree of reaction (parson's turbine) Height of reaction, blade section. Energy losses in steam turbine-internal and external losses in steam turbine.

UNITS – III

State points Locus & Reheat factors: Factor-stage, efficiency of impulse turbine, stage point locus of an impulse turbine, state point locus for multistage turbine reheat factor. Internal efficiency, overall efficiency, relative efficiency, Design procedures of impulse & impulse reaction turbine. Governing of steam turbine: Throttle governing, nozzle governing, bypass governing, combination of throttle and nozzle, governing and combination of bypass and throttle governing, Effect ofgoverning on the performance of steam turbine.

UNIT – IV

Gas turbine: Classification of Gas turbine, simple open cycle gas turbine, ideal and actual (Brayton cycle) for gas turbine, Optimum pressure ratios for maximum specific output in actual gas turbine, Regeneration, reheat and inter cooling and effect of these modification on efficiency and output, closed cycle gas turbine.

UNIT –V

Turbo compressors: Introduction, classification of Centrifugal Compressor- Component working, velocity diagram, calculations of power and efficiencies. Slip factor, surging and choking, power and efficiencies. Axial Flow Compressor: Construction and working, velocity diagram, calculation of power and efficiencies, Degree of reaction, work done factor, stalling, comparison of centrifugal and axial flow compressor.

TEXT BOOKS:

1. Steam and Gas Turbine – R. Yadav by C.P.H. Publication, Allahabad.
2. Turbine, Compressors and Fans – S.M. Yahya – TMH.
3. Gas Turbine – V. Ganeshan – TMH.
4. Fundamentals of Turbo Machinery- Venkanna, PHI.

COURSE OUTCOMES:

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

- Apply knowledge of turbo machinery for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in the design and development of mechanical systems.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- 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	PSOs1	PSOs2	PSOs3
CO1	3	2	2	3	3							3	3	2	3
CO2	3	3	3	3	2							3	3	2	2
CO3	3	3	3	3	3	2						3	2	3	-
CO4	3	1	2	1	1	3						2	3	2	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TOE33	Strategic Management	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To expose students to various perspectives and concepts in the field of Strategic Management.
- The course would enable the students to understand the principles of strategy formulation, implementation and control in organizations.
- To help students develop skills for applying these concepts to the solution of business problems.
- To help students master the analytical tools of strategic management.

COURSE CONTENT:

UNIT- I

Strategy and Process: Conceptual framework for strategic management, the Concept of Strategy and the Strategy Formation Process – Stakeholders in business –Vision, Mission and Purpose– Business definition, Objectives and Goals – Corporate Governance and Social responsibility-case study.

UNIT- II

Competitive Advantage & External Environment: Porter's Five Forces Model-Strategic Groups Competitive Changes during Industry Evolution- Globalization and Industry Structure - National Context and Competitive advantage Resources-Capabilities and competencies–core competencies-Low cost and differentiation Generic Building Blocks of Competitive Advantage- Distinctive Competencies- Resources and Capabilities durability of competitive Advantage- Avoiding failures and sustaining competitive advantage-Case study.

UNIT- III

Strategies: The generic strategic alternatives, Stability, Expansion, Retrenchment and Combination Business level strategy, Strategy in the Global Environment, Corporate Strategy, Vertical Integration- Diversification and Strategic Alliances, Building and Restructuring the corporation- Strategic analysis and choice, Environmental Threat and Opportunity Profile (ETOP), Organizational Capability Profile Strategic Advantage Profile, Corporate Portfolio Analysis, SWOT Analysis, GAP Analysis, Mc Kinsey's 7s Framework, GE 9 Cell Model, Distinctive competitiveness, Selection of matrix, Alance Score Card-case study.

UNIT- IV

Strategy Implementation & Evaluation: The implementation process, Resource allocation, designing organizational structure-Designing Strategic Control Systems, Matching structure and control to strategy- Implementing Strategic change-Politics-Power and Conflict, Techniques of strategic evaluation & control- case study.

UNIT- V

Other Strategic Issues: Managing Technology and Innovation, Strategic issues for Non Profit organizations. New Business Models and strategies for Internet Economy-case study.

COURSE OUTCOMES:

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

- Understand the basic concepts and principles of strategic management.
- Analyze the internal and external environment of business.
- Develop and prepare organizational strategies that will be effective for the current business environment.
- Devise strategic approaches to managing a business successfully in a global context.
- Understand the problems and prospects related to setting up of any type of business and resolve by applying different strategies.

TEXT BOOKS:

- Thomas L. Wheelen, J.David Hunger and Krish Rangarajan, Strategic Management andBusiness policy, Pearson Education., 11th edition, 2007.
- Charles W.L.Hill & Gareth R.Jones, Strategic Management Theory, An Integrated approach, Biztantra, Wiley India,6th edition, 2007.
- Azhar Kazmi, Strategic Management & Business Policy, Tata McGraw Hill, Third Edition.
-
- **Mapping of Course Outcomes (COs) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):**
-

CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	2	2	1	1						1	1	2	2	2
CO 2	2	2	2	1	1						2	2	3	2	2
CO 3	2	2	2	2	1						2	2	2	2	2
CO 4	1	2	2	-	1						1	1	1	1	1
CO 5	1	-	1	2	-						1	1	1	2	1

-

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech. VII Sem.	IP207TMC02	Environmental Sciences	3	-	-	-	-	-	-	-

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

- To learn the importance of Ecosystems, Natural Resources and Energy resources
- To learn the importance of Biodiversity and Environmental pollution
- To understand the Environmental ethics

COURSE OUTCOMES:

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

- To understand the importance of Ecosystems, Natural Resources and Energy resources, learn the importance of Biodiversity and Environmental pollution and understand the Environmental ethics.

COURSE CONTENT:

Introduction to environmental studies Multidisciplinary nature of environmental studies: scope and importance: Concept of sustainability and sustainable development. Ecosystems: structure and function of ecosystem: Energy flow in an ecosystem: food chains. Food webs and ecological succession a) Forces: ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, Streams lakes, rivers, Oceans, estuaries). Natural Resources Renewable and Non-renewable Resources: Land resources and land use change: Land degradation, soil erosion and desertification. Deforestations: Causes and impacts due to mining, dam building on environment, forests biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts. Conflicts over water (international & inter-state) Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies Biodiversity and Conservation: Levels of biological diversity: genetic species and ecosystem diversity. Bio geographic zones of India.

Biodiversity patterns and global biodiversity hot spots India as a mega-biodiversity nation. Endangered and endemic species of India. Threats to biodiversity: Habitat loss poaching of wildlife

man wildlife conflicts, biological invasions: Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value. Environmental pollution: Environmental pollution types, causes, effects and controls: Air, Water, soil and noise pollution. Nuclear hazards and human health risks. Solid waste management: Control measures of urban and industrial waste. Pollution case studies. Environmental potencies & practices, Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment laws Environment protection Act: air (prevention & Control of pollution) Act: water (prevention and control of pollution) Act: wildlife protection Act: Forest Conservation Act; International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD), Nature reserves. tribal populations and rights, human wildlife conflicts in Indian context. Hunan Communities and the Environment. Human population growth: Impacts on environment. Human health and welfare. Resettlement and rehabilitation of project affected persons: case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements Chipko, silent valley Bishnois of Rajasthan. Environmental ethics: role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e. g.CNG vehicles in Delhi). Field work: visit to an area to document environmental assets. River/ forest/flora/fauna, etc. Visit to a local polluted site-urban/rural/Industrial/Agricultural. Study of common plants birds and basic principles of identification Study of simple ecosystems-pond river-etc.

TEXT BOOKS:

1. Gleick P.H.1993 Water in Crisis Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute Oxford Univ.press.
2. Grumbine.R. Edward and pandit M.K.2013 Threats from India's Himalaya dams Science 339;36—37
3. Sengupta R 2003 Ecology and economics: An approach to sustainable development OUP.
4. sodhi, N.S.Gibson L.& Raven P.H.(eds) 2013 Conservation Biology: Voices from the Tropics john wiley & Sons.

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B. Tech. VII Sem.	IP207PPC08	CAD/CAM Lab			2	30	20	50	1

COURSE LEARNING OBJECTIVES:

- To provide students with the writing and reading principles of "Engineering Drawing", which is a graphical universal language used in technical world for describing the shape and size of an object via supplying orthographic views and/or solid models associated with all the necessary dimensions, associated tolerances and annotations created in a CADD environment.
- To understand 3D drafting and analysis software used for modelling and analysis.

COURSE OUTCOMES:

CO1: Ability to perform both 2D and 3D drafting of component using CAD software.

CO2: Ability to construct assemblies from the concepts learnt using drafting software.

CO3: To develop the skills of the CAM.

LIST OF EXPERIMENTS:

- Create solid models of objects, objects in basic shapes, composite bodies, custom built machine parts, building modules etc.
- Draw the orthographic views of an object in CAD environment (particularly in Autodesk AutoCAD environment).
- Create the orthographic views of an object from the solid model (particularly in Autodesk Inventor environment).
- Dimension the views, show some annotations, provide the size tolerance of functional features, and general tolerances.
- Explain and interpret the dimensions and the associated tolerances, some annotations.
- Read the given orthographic views; i.e., visualize the 3- Dimensional model of the object shown to its orthographic views and create its CAD model.
- Create auxiliary views, revolved views, sectional views.
- To study the characteristic features of CNC machine.

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

CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	-	3	2	3	-	-	-	-	-	-	1	2	2	1
CO 2	3	-	3	2	3	-	-	-	-	-	-	1	2	2	1
CO 3	3	1	-	1	-	-	-	-	-	-	-	1	2	2	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B. Tech. VII Sem.	IP207PSC02	Seminar on Summer Training	-	-	4	50	-	50	2

COURSE LEARNING OBJECTIVES:

- To provide comprehensive learning platform to students where they can enhance their employ ability skills and become job ready along with real corporate exposure.
- To enhance students' knowledge in one particular technology.
- To increase self-confidence of students and helps in finding their own proficiency.
- To cultivate student's leadership ability and responsibility to perform or execute the given task.
- To provide learners hands on practice within a real job situation.
- Enhance and supplement the knowledge and skills of the students.
- Develop the students in terms of ability, competence and interpersonal relationship.

COURSE OUTCOMES:

- Capability to acquire and apply fundamental principles of engineering, become familiar in one's specialized technology and become updated with all the latest changes in technological world.
- Develop a skill of a multi-skilled engineer with sound technical knowledge, management, leadership and entrepreneurship skills.
- Ability to identify, formulate and model problems and find engineering solution based on a systems approach.
- Capability and enthusiasm for self-improvement through continuous professional development and life-long learning.
- Awareness of the social, cultural, global and environmental responsibility as an engineer.

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

CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	1	1	2	2	2								2	2	1
CO 2	2	2	2	1	1								1	1	1
CO 3	2	3	3	2	1								1	1	2
CO 4	-	-	-	-	1								1	2	2
CO 5	-	-	-	-	-								1	1	2

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

Department of Industrial & Production Engineering

SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG

B.Tech In Industrial and Production Engineering
Final Year (VIII Semester)

CBCS-New, Study & Evaluation Scheme
Effected From Session: 2022-2023

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING AND TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2022-2023
B. TECH FOURTH YEAR, VIII SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP208TPC15	Robotics and Robot Applications	3	1	-	30	70	100	4
2.	IP208THS4.	Electives from Humanity Science-04	3	-	-	30	70	100	3
3.	IP208TOE4.	Open Elective-04	3	-	-	30	70	100	3
4.	IP208TOE5.	Open Elective-05	3	-	-	30	70	100	3
5.	IP208TMC03	Essence of Indian Knowledge Tradition	3	-	-	-	-	-	-
Total			**15**	**1**	**-**	**120**	**280**	**400**	**13**
PRACTICALS									
1.	IP208PPR02	Major Project	-	-	12	120	80	200	6
2.	IP208PCV01	Comprehensive Viva	-	-	-	-	50	50	2
Total			**-**	**-**	**12**	**120**	**130**	**250**	**8**

Total Credits: **21**
Total Contact Hour: **28**
Total Marks: **650**
INTERNAL ASSESSMENT: -two class tests of 15 marks each will be conducted.
L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP208THS4. Electives from Humanity Science-04
IP208THS41 Intellectual Property Rights
IP208THS42 Safety Management and Labour Law
IP208TOE4. Open Elective-04
IP208TOE41 Product Design and Manufacturing
IP208TOE42 Microprocessors in Automation
IP208TOE5. Open Elective-05
IP208TOE51 Supply Chain Management
IP208TOE52 Composite Materials Technology
IP208TOE53 Finite Element Method

Department of Industrial & Production Engineering

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B.Tech In Industrial and Production Engineering
Final Year (VIII Semester)

Programme Outcomes:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1: Identify, formulate, model, design and analyse concepts to empower comprehensive knowledge allied with industrial and Production Engineering courses to the real-world applications.
PSO2: To develop expertise in solving complex technical, industrial engineering or managerial problems related to industries through innovative solutions using technological skills, analytical aptitude, communication flair and team spirit.
PSO3: To apply theoretical and practical knowledge to solve the industrial and societal problems in the broad areas of production and industrial engineering with demonstration of leadership qualities and betterment of organization, environment and society.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TPC15	Robotics and Robot Applications	3	1	-	15	15	70	100	4

COURSE LEARNING 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.

Syllabus 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. Robotics for engineers, Yoram Korean, McGrew Hill Co.
3. Industrial Robotics Technology programming and Applications, M.P. Groover, M. Weiss.
4. Robotics Control Sensing, Vision and Intelligence - K.S. Fu, R.C. Gonzalex, C.S.G. Lee, McGrew Hill Book Co.
5. Kinematics and Synthesis of linkages, Hartenberg & Denavit, McGrew Hill Book Co.
6. Kinematics and Linkage Design, A.S. Hall, Prentice Hall.
7. Kinematics and Dynamics of Machinary, J. Hirchhorn, McGrew Hill Book Company.

COURSE OUTCOMES:

At the end of the course the students 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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B. Tech VIII Sem.	IP208THS41	Intellectual Property Rights	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objectives of this course are:

1. Understand, define and differentiate various types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
2. Understand the framework of strategic management of Intellectual Property (IP).
3. Appreciate and appraise different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs.
4. Explain how to derive value from IP and leverage its value in new product and service development.
5. To create awareness international aspects of IPR and the Emerging Trends in IPR.

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.

COURSE OUTCOMES:

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

1. 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.

2. 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.
3. Analyze ethical and professional issues which arise in the intellectual property right context.
4. Apply intellectual property right principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual property rights.
5. Demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.

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.,

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

COs	**POs**												**PSOs**		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs1	PSOs2	PSOs3
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

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208THS42	Safety Management & Labour Law	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

1. Understand roles, responsibilities importance of health safety, and welfare in workplaces.
2. Impart knowledge about material handling, air pollution control system, fire prevention and protection.
3. Learn about safety audit, disaster control, safety principles.
4. 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

Safety in metal working machinery and wood working machines: General safety rules, principles, maintenance, inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes, saws, types, hazards.

MODULE -IV

Fire prevention and protection: Sources of ignition, 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, maintenance of fire trucks, foam generators, escape from fire rescue operations, fire drills, notice first aid for burns.

MODULE -V

Explosion protecting systems: Principles of explosion, detonation and blast waves, explosion,

parameters, explosion protection, containment, flame arrestors, isolation, suppression, venting, explosion relief of large enclosure, explosion venting, inert gases, plant for generation of inert gas rupture disc in process vessels and lines explosion, suppression system based on carbon dioxide (CO_2) and halons-hazards in LPG, ammonia (NH_3), sulphur dioxide (SO_2), chlorine (Cl_2) etc.

COURSE OUTCOMES:

1. Apply the knowledge of safety management and labour laws in factory.
2. Develop an insight into the wages law, factory act etc.
3. Analyse the natures of accidents and its effects.
4. Design the system for prevention of various types of hazards in industry.
5. Make Guidelines and advice the work force and management , in implementing the safety norms

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

COs	**POs**												**PSOs**		
	PO 1	PO 2	PO 3	PO 4	PO 5	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)**

TEXT & REFERENCE BOOKS:

1. Accident Prevention Manual for Industrial Operations, N.S.C. Chicago, 1982.
2. Industrial Accident Prevention, H.W Heinrich, 1980, McGraw-Hill Company, New York.
3. Hand Book 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 Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TOE41	Product Design and Manufacturing	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this Course is to:

1. Competence with a set of tools and methods for product design and manufacturing
2. Develop confidence in your own abilities to create a new product.
3. Create awareness of the role of multiple functions in creating a new product (e.g., marketing, finance, industrial design, engineering, production).
4. Apply creative process techniques in synthesizing information, problem-solving and critical thinking

COURSE CONTENT:

Module 1

Introduction to Product Design and Manufacturing: Design by evolution, Design by innovation, Production-Consumption cycle, Ideas and methods of product realization process, Manufacturing, Logistics & Producibility, Problem Confronting the Designers, Steps of the Engineering Design Process, Defining the Problem and Setting Objectives

Module 2

Product design morphology: Developing Provisional Designs, Evaluation and Decision-Making, The morphology of design (the seven phases)

Product Characteristics: Developing successful products, Attributes of successful product developments, Key factors for successful products, Product Characteristics, Aesthetic Design, Design Principles, Product Message, Visual Design, Elements of Visual Design

Module 3

Value engineering in product design: Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Why poor Value? The Value Engineering Methodology, Information phase, Function Phase, Creativity Phase, Evaluation Phase, Development Phase, Implementation Phase, Case studies

Module 4

Material and Manufacturing process selection: Importance of material selection, Factors affecting the material selection process, Material selection procedures, Design Recommendations, how to select manufacturing process? Primary, secondary and tertiary manufacturing process, Design guidelines, Design for Manufacturing, Design for Assembly, Design for Environment

Product costing: Cost and Price Structure Information Need Sources, Estimating Direct and Indirect Costs, Design and Manufacturing Costs, Ways to Model Manufacturing Costs

Module 5

Rapid Prototyping an introduction: Rapid Prototyping or Additive Manufacturing, Rapid Prototyping: Topography and Photosculpture, Rapid Prototyping - An Integral Part of Concurrent

Engineering, Geometrical Modelling Techniques, Rapid Prototyping Information Workflow, Rapid Prototyping Processes

Reverse Engineering: Reverse Engineering-Definition, Importance, Applications, Process ,3D Scanning Process

Managing Competitiveness: Benchmarking, Outsourcing, Mass customisation

COURSE OUTCOMES:

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

1. Understand the product design and manufacturing process
2. Design and validate technological solutions to defined problems and write clearly and effectively for the practical utilization of their work
3. Discuss various phases of value engineering, analyse the function, approach of function and evaluation of function and to determine the worth and value
4. Select suitable manufacturing processes to manufacture the products optimally and to identify/control the appropriate process parameters.
5. Use basic fabrication methods to build prototype models for hard-goods and soft-goods

TEXT & REFERENCE BOOKS:

1. Product design and development, Eppinger, S. and Ulrich, K., 2015. McGraw-Hill Higher Education
2. Integrated product and process design and development: the product realization process, Magrab, E.B., Gupta, S.K., McCluskey, F.P. and Sandborn, P., 2009. CRC Press.
3. Product design for manufacture and assembly, Computer-Aided Design, Boothroyd, G., 1994.
4. Product design and manufacturing by Prof J Ramkumar and Prof Amandeep Singh Oberoi IIT Kanpur, NPTEL sources

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	2	2	1	2	-	-	-	2	1	1	2
CO2	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO3	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO4	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO5	3	2	2	2	1	2	1	2	-	-	-	1	1	1	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TOE42	Microprocessors in Automation	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

- To understand the fundamentals of PIC microcontroller.
- Understand the working of microcontroller systems and able to determine its hardware and software.
- Interface with real time systems.
- Understand the design application based on microprocessors systems.

COURSE CONTENT:

MODULE - I

Number Systems: Codes, digital electronics, logic gates, combinational circuits design, flip-flops, sequential logic circuits design, counters, shift registers.

Introduction to 8085 functional block diagram, registers, ALU, bus systems, timing and control signals.

MODULE - II

Machine cycles: Instruction cycle and timing states, instruction timing diagrams, memory interfacing.

MODULE - III

Assembly language programming: Addressing modes, instruction set, simple programs in 8085, concept of interrupt, need for interrupts, interrupt structure, multiple interrupt requests and their handling, programmable interrupt controller, interfacing peripherals, programmable peripheral interface (8255).

MODULE - IV

Interfacing analog to digital converter & digital to analog converter, multiplexed seven segments LED display systems, stepper motor control, data communication: serial data communication (8251), programmable timers (8253), 8086/8088 microprocessor and its advanced features.

MODULE - V

Introduction to digital control: Sampling theorem, signal conversion and processing, Z-transform, digital filters, implementation of digital algorithm.

COURSE OUTCOMES:

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

- Learn embedded system and its applications in industry.
- Recognise working of microcontroller architecture and programming model.
- Identify the concept of timer, interrupt, I/O port interfacing with microcontroller.
- Study the concept of interfacing with real time system.

TEXT & REFERENCE BOOKS:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited.
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, Tata

McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall.

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	2	2	1	2	2	1	2	-	-	-	2	1	1	3
CO2	2	3	3	2	2	1	2	2	-	-	-	2	2	3	1
CO3	2	2	3	3	2	2	2	2	-	-	-	3	3	2	2
CO4	3	3	2	1	2	1	3	2	-	-	-	2	2	2	1

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TOE51	Supply Chain Management	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. To understand supply chain activities, process planning, decision phases, importance and management of supply chains.
2. To examine various drivers of supply chain for acquiring effectual performance, ease distribution and acquisition of production resources & Inventories.
3. To understand about uncertainty, risk management, distribution network, role of location, capacity and forecasting in SC.
4. 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, framework 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 practice.

Network design in an uncertain environment: The impact of uncertainty on network design, discounted cash flow analysis, representations of uncertainty, evaluating network design decisions using decision trees, AM tires: evaluation of supply, chain design decisions under uncertainty, risk management and network design 175, making supply chain decisions under uncertainty in practice.

MODULE - III

Planning demand and supply in a supply chain: 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.

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.

MODULE - IV

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 multiechelon cycle inventory, estimating cycle inventory-related costs in practice.

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 multiechelon 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.

MODULE - V

Designing and planning transportation networks: Transportation in a supply chain**,** the role of transportation in a supply chain, modes of transportation and their performance characteristics, transportation infrastructure and policies, design options for a transportation network trade-off in transportation design, tailored transportation, role of IT in transportation risk management in transportation, making transportation decisions in practice.

Managing cross-functional drivers in a supply chain: Sourcing decisions in a supply chain**,** the role of sourcing in a supply chain, in-house or outsource, third-party and fourth-party logistics providers, supplier scoring and assessment, supplier selection-auctions and negotiations contracts and supply chain performance, design collaboration, the procurement process, sourcing planning and analysis, role of IT in sourcing, risk management in sourcing, making sourcing decisions in practice.

COURSE OUTCOMES

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

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, McGraw Hill 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.

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	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

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TOE52	Composite Materials Technology	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

1. Analyze the basic concepts of composite materials and application of composite material in various engineering fields.
2. Apply the requirements for production and application of composite materials.
3. Explain students to various techniques used for composite manufacturing.
4. Describe concepts of nano-materials, nano technology and use of nano materials.
5. Analyze micro mechanical properties of lamina using various approaches.

COURSE CONTENT:

MODULE – I

Introduction to composites: Definitions. typical reinforcements and matrices, properties of fiber composites: mechanical, weight, chemical resistance, etc., compared with standard materials, particular composites, quality assurance, outline of manufacturing methods, economic aspects, dependence of properties on manufacturing route, typical manufacturing defects, applications fiber strengthening, fiber flaws, critical length, critical volume fraction, natural composites (wood, bone, etc.)

MODULE – II

Fiber manufacturing methods: Physical and chemical characteristics, mechanical and other properties of commonly used fibers: carbon, glass, aramid and other organics, ceramics, fiber coating to achieve compatibility with matrix, use of statistical methods to characterize fiber behavior. naturally-occurring (cellulose) fibers, whisker, typical properties, manufacturing methods.

MODULE – III

Manufacture of polymer matrix composites Principles of manufacturing processes (open and closed mould), including: hand and spray lay-up, press moulding, injection moulding, resin injection, RRIM, filament winding, pultrusion, centrifugal casting, autoclave, prepreg and other starting materials, etc., machine methods for manufacture of composites, cutting, drilling and other finishing operations.

MODULE – IV

Engineering properties stiffness and strength: Geometrical aspects, volume and weight fraction, unidirectional continuous fiber systems, stiffness and strength, discontinuous fibers, short fiber systems, length and orientation distributions, woven reinforcements hybrids, failure theories for unidirectional lamina, micro mechanics theories.

MODULE – V

Mechanical testing: Determination of stiffness and strengths of unidirectional composites, tension, compression, flexure and shear, typical standard methods, use of photo elastic, holographic and other methods of strain measurement.

Metal matrix systems: Metals and alloys, solidification processes, diffusion bonding, mechanical properties, boron fibre reinforced aluminium and titanium alloys, alumina fibre reinforced aluminium alloys, silicon carbide fibre reinforced aluminium alloy, particulate systems.

COURSE OUTCOMES:

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

1. Identify and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.
2. Apply competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of fibre-reinforced composite products.
3. Analyse the elastic properties and simulate the mechanical performance of composite laminates; and understand and predict the failure behaviour of fibre-reinforced composites.
4. Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project.
5. Critique and select literature and apply the knowledge gained from the course in the design and application of fibre-reinforced composites.

TEXT & REFERENCE BOOKS:

1. Introduction to Composite Materials Design, Ever J. Barbero, Taylor & Francis.
2. Mechanics of Composite Materials, Robert Jones, Second Edition 1999, Taylor & Francis.
3. Composites and Processing Methods, Venkatesan, Narosa Publications.
4. Composite Material Science and Engineering Krishan K. Chawla Springer Third Edition First Indian Reprint 2015
5. Fibre-Reinforced Composites, Materials, Manufacturing, and Design P.K. Mallick, CRC Press, Taylor & Francis Group Third Edition
6. Mechanics of Composite Materials & Structures, Madhijit Mukhopadhay Universities Press 2004

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

CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	2	2	2	2	1	2	-	-	-	2	1	1	2
CO 2	1	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO 3	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO 4	2	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO 5	3	2	2	2	1	2	1	2	-	-	-	1	1	1	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TOE53	Finite Element Method	3	-	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

The objective of this course is to:

1. Analyze the basic concept about principle of finite element method.
2. Determine the coordinate system and shape function for various element.
3. Learn plotting governing equations of linear and higher order.
4. Define basic concept of matrix formulation.

COURSE CONTENT:

MODULE -I

Basic concept of FEM: Historical background, basic concept and steps in fem, mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, one dimensional second order equation, discretization, linear and higher order elements, introduction of FEM software and steps.

Matrix displacement formulation: Matrix displacement equations, solution of matrix displacement equations, techniques of saving computer memory requirements, finite element formulation.

MODULE -II

Natural coordinate systems and shape function: Basic concept of natural coordinate, 1-D & 2- D natural coordinate, concept of shape functions, convergence requirements, pascal triangle, shape function for linear and plain elements, shape functions using Lagrange polynomials, shape functions for serendipity family elements, degrading technique for nodes.

MODULE - III

Strain displacement matrix: Strain displacement matrix for linear and plain element, strain displacement matrix for beam, linear and plain elements.

Stiffness matrix: Concept of element stiffness matrix for linear and plain elements. stiffness matrix for bar & trusses, stiffness matrix for linear and plain elements, force vectors, body forces and thermal loads, plate and shell elements, finite representation of infinite bodies, element aspect ratio, quadrilateral and higher order element vs mesh refinement.

MODULE - IV

Assembling of stiffness matrix: Assembly of elemental matrices, boundary conditions and solution, direct approach, strain energy, Castigliano's first theorem, minimum potential energy, Galerkin's method, Galerkin's method applied to elasticity problems, weighted residual methods, variational formulation of boundary value problems, Ritz technique, isoparametric formulations.

MODULE - V

Finite element solutions: Numerical integration and application to plane stress problems, solid mechanics and heat transfer, longitudinal vibration and mode shapes, fourth order beam equation, transverse deflections and natural frequencies, bar, trusses & beams, plane stress and plane strain problems, use of higher order elements, solution of dynamic problems application to thermal problems, torsion of non-circular shafts.

COURSE OUTCOMES:

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

1. Apply concept of shape functions for optimizing decision problem.
2. Understand the concepts behind formulation methods in FEM.
3. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
4. Develop element characteristic equation and generation of global equation. Identify boundary conditions to solve dynamic problems under thermal aspects and related to torsion of non-circular shafts.
5. Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.

TEXT & REFERENCE BOOKS:

1. The Finite Element Methods for Engineers, K.H. Huebner & E.A., Thorton, John Wiley & Sons.
2. Concepts and Applications of Finite Element Analysis, R.D. Cook, D.S. Malkus & M.E. Plesha, Third Edition, John Wiley & Sons.
3. Finite Element Method in Engineering, S.S. Rao, Butterworth Heinemann.
4. Finite Element Procedures, K.J. Bathe, Prentice Hall of India, New Delhi.
5. The Finite Element Methods, O.C. Zienewiccz & R.L Taylor, Vol.1 & Vol.2, McGraw Hill.
6. Finite element analysis, S.S. Bhavikatti, New Age Pub.
7. An Introduction to Finite Element Method, J.N., Reddy, Tata McGraw Hill.
8. Text Book of Finite Element Analysis, P. Seshu, Prentice Hall, New Delhi.

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

CO	PO												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	2	2	1	2	-	-	-	2	1	1	2
CO 2	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO 3	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO 4	3	2	3	2	2	2	2	2	-	-	-	2	2	2	2
CO 5	3	2	2	2	1	2	1	2	-	-	-	1	1	1	2

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

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VIII Sem.	IP208TMC03	Essence of Traditional Knowledge	3	-	-	-	-	-	-	-

COURSE LEARNING OBJECTIVES:

1. 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.
2. 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.
3. 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) ४उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र).
- Modern science and Indian knowledge system.
- Yoga and holistic health care.
- Case studies.

COURSE OUTCOMES:

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

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.

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	2	2	1	2	-	-	-	2	1	1	2

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