CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
ME 26011	Fluid Mechanics	4	-	2	3	1	4	70	30	40	60	200

Pre-requisites: ME1055, PH1005, MA1006, MA1056 and IM1059

Course Assessment: The following methods are adopted for the assessment of this course

1. **Class Work** (30 marks) on the basis of regular evaluation of assignments, two mid semester tests and class attendance.
2. **Sessional Work** (40 marks) on the basis of internal viva and continuous laboratory journal assessment and laboratory attendance.
3. **Practical Examination** (60 Marks) on the basis of evaluating practical knowledge, quiz and viva-voce.
4. **Theory Examination** (70 Marks) on the basis of end term theory paper examination.

Course Outcomes:

CO 1	Enhancement of fundamental knowledge of particular engineering discipline
CO 2	Learning of particular engineering skills
CO 3	Enhancement of analytical skills
CO 4	Learning problem solving in particular domain
CO 5	Have knowledge of steady and unsteady flow

COURSE CONTENTS

Unit I

(a) **Introduction**: Fluids and the continuum, Fluid properties, Surface tension, Bulk modulus and thermodynamic properties, Newton's law of viscosity and its coefficients. Newtonian & non-newtonian Fluids.

(b) **Hydrostatics and Buoyancy**: Pascal's law, Hydrostatics law, Force on immersed plane and curved surfaces, center of pressure, laws of buoyancy, Meta center and Metacentric height, Stability of floating bodies.

Unit II

(a) **Fluid Kinematics** : Langragian & Eulerian Method, Description of Fluid Flow, Stream Line, Path line and Streak Line, Types of Flow and Types of motion, local and connective acceleration, continuity equation., Circulation, Velocity potential, Stream function, Laplace equation, Flow nets.

(b) **Compressible Flow**: Introduction, Mach Number, Isentropic Flow, Stagnation Properties.

Unit III

(a) **Fluid Dynamics**: System and control volume, Reynold transport theorem, Euler's equation, Bernoulli's equation, Momentum and Moment of Momentum Equation. Their application,

(b) **Forces on Immersed Bodies**: Lift and Drag, Stream Lined and Bluff bodies, Flow around Circular Cylinders and Aerofoils.

Unit IV

(a) **Viscous Flow**: Preliminary Concepts, governing equations, Viscous flow through parallel plates and pipes

(b) **Flow Through Pipes**: Reynold Number, Laminar and Turbulent flow, Navier Stoke's equation, Pressure gradient, Head loss in Turbulent Flow (Darcey's Equation), Friction factor, Minor losses, Hydraulic and Energy gradient, Pipe networks.

Unit V

(a) **Boundary Layer Theory**. Von Karman Momentum Equation, Laminar Boundary Layer, Turbulent Boundary Layer, Boundary Layer Separation.

(b) **Introduction to Open Channel Flow**

Reference Books:

1. Shames, Fluid Mechanics, Tata McGraw-Hill, 1962
2. Massey, B.S., Mechanics of Fluids, Routledge Publication, 2006
3. Kumar D.S., Fluid Mechanics, S K Kataria Publication, 2003

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
ME 26002	Strength of Materials	4	-	2	3	1	4	70	30	40	60	200

Pre-requisites: CE10003, ME10649

Course Assessment: The following methods are adopted for the assessment of this course;

1. **Class Work** (30 marks) on the basis of regular evaluation of assignments, two mid semester tests and class attendance.
2. **Sessional Work** (40 marks) on the basis of internal viva and continuous laboratory journal assessment and laboratory attendance.
3. **Practical Examination** (60 Marks) on the basis of evaluating practical knowledge, quiz and viva-voce.
4. **Theory Examination** (70 Marks) on the basis of end term theory paper examination.

Course Outcomes:

CO1	Understand elastic constants, types of stresses and mechanical properties of materials
CO2	Apply shear force and bending moment diagrams to analyze the resistance offered by the beam and able to solve practical problems in real world scenario
CO3	Evaluate principal stresses and strains analytically and graphically
CO4	Determine the deflection and curvature in beams with different supports and buckling of column.
CO5	Analyze and design thin cylinders and energy stored due to deformation

COURSE CONTENTS

Unit 1

Stress and Strain: Tension, compression and shear, Complementary shear stresses. Elastic constants and their relationship. Thermal stresses. Statically indeterminate system, Shear stress in a circular member due to Torsion.
Mechanical Testing of materials: Tensile, Compression, Shear, Torsion, Fatigue, Impact, Hardness Tests

Unit 2

Bending Moment and Shear Forces: Diagrams of Shear Forces and Bending Moment for determinate beams. Relation between loads, shearing forces and bending moments.
Bending Stress: Theory of bending, bending and shear stresses in beams and their distributions, modulus of section and modulus of rupture, beams of varying cross section, beam of uniform strength. Introduction to composite beams

Unit 3

Stress on oblique section of a bar subjected to axial stress, compound stress. Principal stress and strain, plane stress and plane strain and their Mohr's Circle. Combined direct and bending stress.

Unit 4

Deflection: Uniform curvature, Relation between curvature and deflection, cantilevers and simply supported beams of varying cross section. Macaulay's method, Moment area method, deflection due to shear. Propped beam. Parts subjected to column action with and without lateral loading.

Unit 5

Elastic strain energy : Resilience, Proof Resilience, Material under tension, Static, Sudden and Falling loads, Strain Energy due to direct shear, bending and torsion, Castigliano's theorem.
Thin walled pressure vessels- stresses, strain and deformation due to internal fluid pressure.

Text Books:

1. Ramamrutham S., Strength of Materials, Dhanpat Rai, 2003
2. Ryder, G.H., Strength of Materials, Macmillan India, 2002

Reference Books:

1. Popov, E.P., Mechanics of Solids, Prentice-Hall (India), 2001
2. Beer &Johnston, Mechanics of Material. Tata McGraw-Hill, 2004
3. Ratan, S.S., Strength of Materials, Tata McGraw-Hill, 2011

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
MA 26004	MATHEMATICS-III	4	1	-	4	-	4	70	30	-	-	100

Course Assessment: The following methods are adopted for the assessment of this course;

1. Internal Assessment for continuous evaluation, mid-term tests, tutorials, class performance, etc. (30%)
2. Theory Examination (70 Marks) on the basis of end term theory paper examination.

Course Outcomes:

The outcomes of this course are:

1. To identify real phenomena as models of partial derivative equations. Solve real problems by identifying them appropriately from the perspective of partial derivative equations
2. To demonstrate their understanding of the Dirichlet conditions by using them to evaluate infinite series. Calculate the Fourier transform of elementary functions from the definition.
3. To select and combine the necessary Laplace transform techniques to solve second-order ordinary differential equations involving the Dirac delta (or unit impulse).
4. To understand the concept of solving differentiation and integration using approximation methods.
5. To define principal concepts about sampling. Explains the advantages of sampling. Lists the stages of sampling process. Categorizes and defines the sampling methods.

COURSE CONTENTS

Unit 1

Partial Differential Equations: Formation of partial differential equations, partial differential equations of first order and first degree i.e., Pp + Qq = R, Linear homogeneous partial differential equation of nth order with constant coefficient, separation of variables, Application to simple problems of heat, Wave and Laplace equations.

Unit 2

Fourier Series and Fourier Transformation : Expansion of functions in a Fourier series, Half range series, Sine and Cosine series and change of interval. Fourier Integral. Fourier transforms: sine and cosine transforms and their application to solution of linear Partial Differential Equations.

Unit 3

Laplace Transform : Definition of Laplace Transform, Laplace Transform of elementary and periodic functions, properties of Laplace Transform including Laplace Transform of derivatives, Inverse Laplace Transform and its properties, Convolution Theorem, Application of Laplace Transform to ordinary differential equations with constant and variable coefficients.

Unit 4

Calculus of Finite Differences : Difference table, Operators E and Δ, Newton's forward and backward interpolation formula for equal intervals, Lagrange's interpolation formula and divided difference method for unequal intervals, Numerical Differentiation and Integration (Trapezoidal rule, Simpson's 1/3 rule ,Simpson's 3/8 rule and Weddle's rule).

Unit 5

Statistics: Brief idea of Sampling, t, F and $\chi 2$ distributions and their applications, ANOVA, Statistical Quality Control (SQC), Control Charts, Sampling inspection, Acceptance sampling, Producer's and Consumer's risk, O. C. curve, Taguchi method.

Textbooks Recommended:

1. Ramana B V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.
2. Das H. K, Higher Engineering Mathematics, S. Chand New Delhi, 2011.

Reference Books:

1. Kreyszig Erwin, Advanced Engineering Mathematics, 8th edition, John Willy and sons Publications, 1999.
2. Jain, R.K. and Iyengar S.K, Advanced Engineering Mathematics, Narosa Publishing House, New-Delhi, 2006.
3. Vedamurthy V.N. & Iyengar S.N., Numerical Methods, Vikas Publishing, 2008.

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
ME 26008	Material Science	3	-	2	3	1	4	70	30	40	60	200

Pre-requisites: CE1001, ME1055, CH1058, PE1091 and IM1059

Course Assessment: The following methods are adopted for the assessment of this course;

4. **Class Work** (30 marks) on the basis of regular evaluation of assignments, two mid semester tests and class attendance.
5. **Sessional Work** (40 marks) on the basis of internal viva and continuous laboratory journal assessment and laboratory attendance.
6. **Practical Examination** (60 Marks) on the basis of evaluating practical knowledge, quiz and viva-voce.
7. **Theory Examination** (70 Marks) on the basis of end term theory paper examination.

Course Outcomes:

CO1	Understand the significance of different crystal structures of different materials.
CO2	Select the material based on their mechanical properties for suitable applications.
CO3	Describe phase diagrams and iron-carbon equilibrium diagram, and choose particular heat treatment cycle based on TTT diagram.
CO4	Explain the behavior of material upon heat treatment from iron-carbon equilibrium diagram and predict the behavior of materials upon impact, fracture.
CO5	Describe various non-destructive tests and basics of Nano-materials.

COURSE CONTENTS

Unit 1

Basic crystallography and properties of engineering materials: Seven crystal systems. Bravais lattice. Symmetry and properties of the simple crystal structure. Miller indices. Direction and Plane indices.

Techniques of Crystal growing. Growth of single crystals from melt. Lattice vacancies, Schottky and Frenkel defects. Diffusion in solid, Fick's law.

Dislocation, Edge dislocation, Screw dislocations, Slip planes. Stress fields of dislocations. Grain boundaries, Dislocation densities, Strength of alloys, Dislocation and crystal growth.

Unit 2

Stress-strain diagrams for engineering materials and Mechanical working of metals: Various mechanical properties like strength, stiffness, elasticity, plasticity, ductility, hardness, impact strength, malleability, brittleness, toughness, resilience, etc. Hot and cold working of metals and their effects on properties.

Alloying: characteristics of alloying elements C, Mn, Cr, Ni, Ph, S, Mo, Pb, Si, etc. The effects of alloying elements on the mechanical behavior of steel Cu, Al, etc.

Unit 3

Equilibrium Diagram: Allotropy structure of alloys, Lever rule, phase rule, various types of phase diagrams. Cooling curves, Iron carbide equilibrium diagram. Heat treatment of metals and alloys: Strengthening mechanisms, TTT diagram, Heat treatment procedure for steel, Hardening, Hardenability, Surface hardening of Steel, Defects in heat treated Parts. Creep and stress rupture.

Unit 4

Ferrous and Non-ferrous metals and alloys: Properties and application of various steels and cast irons. Effect of impurities in ferrous metal. Effect of common alloying elements on the steels, High-speed steels, Stainless steel, Other steels. Corrosion and its prevention. Composition Microstructure, Properties and application of aluminium and its principle alloys, Copper and its principle alloys. Metallurgical aspects of metal joining, plastics and polymers.

Powder Metallurgy: Manufacturing of metal powders. Sintering and secondary operations. Projects of finished parts. Design considerations and applications. Composite materials. Shape memory alloy metallic glasses.

Unit 5

Failure Analysis of machine parts based on metallurgical aspects like crystal structure variations, crack propagation, the inclusion of impurities, machining effects on normalizing and quenching process of heat treatment surface materials. Non-destructive Testing. Basics of Nano-materials.

A brief discussion of the properties and applications of the rare metals. Composite materials type and their characteristics.

Textbooks Recommended:

1. Abdul Mubeen, Material Science, Galgotia Publications, 2003
2. Raghvan V., Material Science, and Engineering, PHI Learning Pvt. Lt, 2006
3. Callister, William D. Fundamentals of materials science and engineering. Wiley, 2000.

Reference Books:

1. Cedric W. Richards, Engineering Material Science, Literary Licensing, LLC, 2012
2. Chalmers, Physical Metallurgy, Chapman & Hall, London, 1969
3. John Walff, Structure and Properties of Material, J Wiley Eastern University Ed., 1986

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
ME 26005	Engineering Thermodynamics	3	-	2	3	1	4	70	30	40	60	200

Pre-requisites: ME 10055, PH 10005, CH 10058, ME 10007 and MA 2604.

Course Assessment: The following methods are adopted for the assessment of this course

1. **Class Work** (30 marks) on the basis of regular evaluation of assignments, two mid semester tests and class attendance.
2. **Sessional Work** (40 marks) on the basis of internal viva and continuous laboratory journal assessment and laboratory attendance.
3. **Practical Examination** (60 Marks) on the basis of evaluating practical knowledge, quiz and viva-voce.
4. **Theory Examination** (70 Marks) on the basis of end term theory paper examination.

COURSE OUTCOMES:

CO1	Define first and second laws of thermodynamics and explain their applications.
CO2	Evaluate entropy changes in a wide range of processes and determine the available and unavailable energy. Analysis for the performance of different air standard cycles.
CO3	Evaluate properties of pure substances and gas mixtures. Demonstrate various types of high pressure boilers and their relative merits and demerits.
CO4	Performance evaluation of boilers. Apply the fundamentals of thermodynamics for analysis of boiler performance. Procedure to draw Heat Balance Sheet.
CO5	Understand the concept of draught. Evaluate draught created by chimney. Demonstrate reactive system of combustion process for different fuels. Analyze dry flue gases.

COURSE CONTENTS

Unit 1

(a) **First Law of thermodynamics:** Work and Heat Transfer, First Law of thermodynamics applied to a closed system, applied to Steady and variable Flow Processes.

(b) **Second Law of Thermodynamics:** Limitations of First law of thermodynamics, Heat Engine and Heat Pump, Kelvin Plank and Clausius statements and their equivalence, Reversibility and Irreversibility, Causes of irreversibility, Carnot's Theorem.

Unit 2

(a) **Entropy & Availability:** Clausius theorem, Clausius inequality, entropy principle, calculation of entropy, changes for various processes, principle of increase of entropy, Available and unavailable energy, Maximum Work in a Reversible Cycle.

(b) **Air Standard Cycles:** Otto, Diesel, Dual and Brayton Cycles; Air Standard Efficiencies; Mean Effective Pressure. Condition for maximum work output from these cycles. Comparison between Otto, Diesel and Dual cycles for different conditions.

Unit 3

(a) **Properties of Steam:** P-v diagram, p-T diagram, p-v-T surface, T-s diagram, Mollier diagram, Types of steam, dryness fraction, calculation of Enthalpy, specific volume, internal Energy and entropy of steam, Heating cooling and expansion of steam.

(b) **High Pressure Boilers:** Fire tube and water tube boilers, Advantages of high pressure boilers, Construction and working of Lamont Boiler, Benson Boiler, Loeffler Boiler, Schmidt-Hartmann Boiler and Velox boilers, their Relative Merits and Demerits.

Unit 4

Boiler Performance: Evaporation, Equivalent Evaporation, factor of Evaporation. Boiler efficiency. Factors affecting Performance of Boilers. Boiler Trials. Heat Balance Sheet.

Unit 5

(a) **Draught:** Types of draught. Natural Draught and artificial Draught viz. Mechanical draught (Forced, Induced and Balanced) and Steam Jet Draught. Height of the chimney required for Natural Draught. Condition for maximum discharge through chimney, efficiency of chimney.

(b) **Combustion**: Principle of combustion, Stoichiometric Combustion, Analysis of flue gases by Orsat Apparatus. Requirement of Theoretical Amount of Air, Calculation of Constituents of Flue Gas with Excess Air, Optimizing Excess Air and Combustion.

Text Book Recommended:

1. Kumar, D.S., Thermodynamics, Kataria & Sons Publication, 2003
2. Nag P.K., Engineering Thermodynamics, Tata McGraw-Hill, 1988
3. R Yadav, Fundamentals of Thermodynamics, Central Publishing House, 1999

Reference Books:

1. Van Wylen, Thermodynamics, Wiley, 1994
2. Mathur & Mehta, Thermal Engineering, Jain Brothers Publication, 1987
3. Cengel Y A, Thermodynamics, Tata McGraw-Hill, 2008

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
ME 26555	Mathematics-IV	4	1	-	4	-	4	70	30	-	-	100

Course Assessment: The following methods are adopted for the assessment of this course;

1. Internal Assessment for continuous evaluation, mid-term tests, tutorials, class performance, etc. (30%)
2. End semester Theory Exam (70%)

Course Outcomes: The outcomes of this course are

- to obtain the series solution of Bessel's and Legendre's differential equations.
- to understand the concept of vector calculus and its applications.
- to understand the various concepts of function of complex variables and its applications.
- to apply the concept of numerical analysis for solving linear, nonlinear and Ordinary equations.

COURSE CONTENTS

Unit 1

Special Functions: Method of Frobenius series solution for Bessel and Legendre's Differential Equations, Recurrence relation, Generating functions and Orthogonality of Bessel's function and Legendre's function.

Unit 2

Vector Calculus: Gradient, Divergence and Curl, Vector Identities, Directional derivative, line, surface and volume integrals, Applications to Gauss, Stokes and Green's theorem.

Unit 3

Functions of Complex Variables-I : Analytic Functions, Cauchy-Continuity, Analytic Functions, Cauchy Riemann equations in Cartesian and Polar Coordinates, Harmonic and Conjugate Harmonic functions, Complex Integration – Cauchy's Integral Theorem and Cauchy Integral Formula

Unit 4

Functions of Complex Variables-II: Taylor's series (Theorem), Laurent Series (Theorem), Zeros and poles, Residue Theorem, Evaluation of simple Real Integrals. Conformal Mapping-Mapping of Elementary functions $w = z^n$, z^2, e^2, sinz, Bilinear Transformations.

Unit 5

Numerical solution of linear and non-linear algebraic equations: Bisection (or Bolzano) method, method of false position, Newton Raphson method. Solution of Simultaneous algebraic equations: Direct method- Gauss Elimination method, Gauss Jordan method, Iterative method-Jacobi's method, Gauss Seidal method. Numerical Solution of Ordinary Differential Equations: Taylor's Method, Picard's Method and Runge-Kutta Method.

Text Books:

Ramana B V, Higher Engineering Mathematics, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.

Das H. K, Higher Engineering Mathematics, S. Chand New Delhi, 2011.

Balaguruswamy E., Numerical Methods, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1999.

Reference Books:

Jain, R.K. and. Iyengar S.K, Advanced Engineering Mathematics, Narosa Publishing House, New-Delhi , 2006

Sastry S.S., Engineering Mathematics, Prentice Hall of India private limited, New Delhi.

Vedamurthy V.N. and Iyengar S.N., Numerical Methods, Vikas Publishing, 2008.

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
ME 26551	Machine Design I	3	-	2	3	1	4	70	30	40	60	200

Pre-requisites: ME 10149 and ME 26002

Course Assessment: The following methods are adopted for the assessment of this course;

1. **Class Work** (30 marks) on the basis of regular evaluation of assignments, two mid semester tests and class attendance.
2. **Sessional Work** (40 marks) on the basis of internal viva and continuous laboratory journal assessment and laboratory attendance.
3. **Practical Examination** (60 Marks) on the basis of evaluating practical knowledge, quiz and viva-voce.
4. **Theory Examination** (70 Marks) on the basis of end term theory paper examination.

Course Outcomes: Students will be able to-

CO1	Understand machine component behaviour under different types of loads, select factor of safety and identify the failure criteria.
CO2	Design keys, cotters, couplings, joints and lever
CO3	Design of pressure vessels and pipe joints
CO4	Design of bolted joint, effect of contact stress and selection of antifriction bearing
CO5	Design of riveted and bolted joints

COURSE CONTENTS

Unit 1

Engineering design, Phases of design, design consideration, Ergonomics consideration, Factor of safety, Material selection, manufacturing consideration, Standardization, Preferred sizes

Modes of failure, Types of loads, statistical nature of loading, change in stresses due to type of loading, preliminary stress calculations

Theories of failure and application to the design problems: Principal stress theory, maximum shear stress theory, principal strain theory, maximum strain energy theory, maximum distortion energy theory, etc.

Unit 2

Design of shaft, keys and coupling: Types of keys and their design, design for transmission by shaft through rigid and flexible coupling, stress distribution and angle of twist. Design of different types of lever.

Unit 3

Pressure vessels and cover plates: Analysis of thick pressure vessels, compound cylinders, design considerations for pressure vessels

Pipe and pipe joints: design of different types of pipe joints for high pressure

Design of cotter joint and knuckle joint,

Unit 4

Threaded fasteners: Classification, standard specifications, effect of initial tension, Effect of static and dynamic load, eccentric loading, types of nut – bolt – washers. design of threaded fasteners, turnbuckle

Contact stress and deformation: Contact surfaces - their geometries and deformations. contact stress distributions. Antifriction bearing: types of bearings, life and load criteria of bearings, different applications and selection procedure of bearings.

Unit 5

Design of Riveted Joints: Types of rivet joints, rivet heads, terminology, caulking and fullering, analysis of riveted joint, efficiency of a riveted joint, design of boiler joints and structural joints, direct and eccentric loading.

Design of Welded Joints: Welding process, merits and demerits of welded joint, analysis of heat affected zone, Types of welded joints, Strength of a welded joint, welded joint subject to bending moment, torsional moment, direct and eccentric loading

Text Books:

1. Sharma and Aggarwal, Machine Design, S K Kataria and Sons, 2001
2. V. Bhandari, Introduction to Machine Design, Tata McGraw-Hill, 2004

Reference Books:

1. R. C. Juvinall and K. M. Marshek, Fundamentals of Machine Component Design, John Wiley, 1991
2. Shigley and Mischke, Mechanical Engineering Design, Tata McGraw-Hill, 2001

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
ME 26562	Kinematics of Machine	3	-	2	3	1	4	70	30	40	60	200

Pre-requisites: ME 1007, ME 1055, CE 1001, EE 1002 and PH 1005.

Course Assessment: The following methods are adopted for the assessment of this course

1. **Class Work** (30 marks) on the basis of regular evaluation of assignments, two mid semester tests and class attendance.
2. **Sessional Work** (40 marks) on the basis of internal viva and continuous laboratory journal assessment and laboratory attendance.
3. **Practical Examination** (60 Marks) on the basis of evaluating practical knowledge, quiz and viva-voce.
4. **Theory Examination** (70 Marks) on the basis of end term theory paper examination.

Course Outcomes: Students will be able to-

CO 1	Learn basic mechanisms for motion transmission and number synthesis
CO 2	Determine kinematic analysis (Velocity, acceleration, Inertia forces) for a given mechanism using analytically and graphically method.
CO 3	Construct different types of cam profile for a given data.
CO 4	Learn different types of gears and gear trains
CO 5	Gyroscopic analysis and synthesis of basic four link mechanisms

COURSE CONTENTS

Unit 1

Kinematic link, Kinematic pairs, Kinematic chain, classification, Inversion of four bar chain, single slider crank chain, and double slider crank chain. Degree of freedom of chain and mechanism, Grubler's and Kutchbach Criterion.

Number synthesis with number of links less than or equal to eight.

Mechanism with lower pairs, Straight line mechanism, Pantograph, Steering gear mechanisms, Hook's joint, Engine Indicator mechanism.

Unit 2

Velocity and acceleration analysis, Graphical approach, Relative velocity and relative acceleration approach, Problems with corioli's component of acceleration. Klein's construction, Instantaneous centre method, Keneddy's theorem and its applications.

Analytical method: Velocity and acceleration of single slider crank chain. Complex algebra approach to various mechanism

Unit 3

Cams: Types of cams and followers, Reciprocating and Oscillating followers, Cam profiles with specified follower motion e.g. simple harmonic motion, uniform velocity motion, Uniform acceleration and retardation motion and cycloidal motion. Cam with specified contours, Displacement, velocity and acceleration of followers.

Unit 4

Toothed Gearing: Spur gearing, definition, Condition for correct gearing. Tooth profiles- cycloidal and involute gears, Tooth proportions, Interference and its prevention, Bevel gearing, Helical gearing, Worm and wheel

Gear trains, Simple, Compound, Reverted and Epicyclic Gear trains and their applications, Tabular and algebraic approach of solution. Differential gear box.

Unit 5

Gyroscopes : Products of Inertia, Principle Axis, Gyroscopic Motion, Gyroscopic Torque, Gyrostabilizer, Gyrocompass, Application to Ships, Aero planes, Automobiles and two wheel vehicles.

Synthesis of basic four link mechanism.

Text Books:

1. Bevan T., Theory of Machines, C B S Publishers, 1993
2. Ambekar A. G., Mechanism & Machine Theory, Prentice-hall of India, 2007
3. Ratan S.S., Theory of Machines, Tata Mcgraw Hill, 2009

References Books:

1. Shigley J. E., Theory of Machines (Kinematics), Tata Mcgraw Hill, 1981

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
EC 26563	BASIC ELECTRONICS ENGG	4	-	2	3	1	4	70	30	40	60	200

Pre-requisites: Mathematics-I, Physics

Course Assessment:

The following methods are adopted for the assessment of this course;

1. **Sessional Work** (40 marks) on the basis of internal viva and continuous laboratory journal assessment and laboratory attendance.
2. **Practical Examination** (60 Marks) on the basis of evaluating practical knowledge, quiz and viva-voce.

Course Outcomes: Student should be capable of:

1. Design and analyze diode based electronics circuits and subsystem which can perform logical and arithmetic operation.
2. Analyze BJT based electronic circuits.
3. Understand the digital circuits through basic logic gates.
4. Analyze and design converters which facilitate the conversion of real world analog signals to digital and vice versa.
5. Understand basic internal logic and design of microprocessor and its programming.

COURSE CONTENTS

Unit 1

General principles, working and characteristics of semiconductor diodes, transistors, introduction to rectifiers and amplifiers.

Unit 2

Power supply and their ratings, CRO, Multi-meter, Function Generator, their specifications and applications in testing and measurement.

Unit 3

Binary numbers, their additions, subtraction etc., Boolean algebra, logic gates, logic functions, realization of logic gates by electronic devices, positive and negative logic, half adder, full adder, coder, decoder, flip-flop, synchronous and asynchronous circuits, counters, registers, memories.

Unit 4

Digital display systems, LED and seven segment display concept and use of D/A and A/D converters.

Unit 5

Introduction to Microprocessors, Programmers view to 8085 and its application.

Books & References Recommended

1 Bapat Y.N., Electronics Circuit and Systems- Analog and Digital TMH
2 Gaonkar, Introduction to Microprocessor, Wiley Easter
3 Theraja B.L., Basic Electronics (Solid State), 1993, S. Chand
4 Malvino, Basic Electronics TMH
5 Morris Mano, Digital Circuits & Logic Design,2nded., 2000, PHI

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
IP 26009	Manufacturing Processes-I	4	-	2	3	1	4	70	30	40	60	200

Pre-requisites: ME 1007, ME 1055, CE 1001, EE 1002 and PH 1005.

Course Assessment: The following methods are adopted for the assessment of this course

Theory paper:

(1) End Semester Exam: 70% weightage,
(2) Continuous assessment: 30% weightage (Two midterm tests: 67% weightage, assignment: 16.5% weightage, regularity 16.5% weightage)
Practical:
(1) Sessional: 40% Weightage (Continuous assessment of experiments and lab manual 50% weightage, final viva 25% weightage, regularity 25% weightage.)
(2) End semester practical viva: 60% weightage.

Student Learning Outcomes:

Upon successful completion of course, Students should be able to

1. Gain thorough knowledge of welding processes and their classifications.
2. Know about forming process and force analysis in metal forming
3. Know about various welding equipment's.
4. Gain knowledge of robotic welding
5. Know about the measuring tools and different welding positions and welding joints.

1. Understand the underlying principles and process of common casting processes
2. Understand the construction and operations of common melting furnaces
3. Provide the various allowances to the patterns and convert the OEM drawing to pattern drawing
4. Design the core considering strength and other conditions
5. Design multi-cavity layout
6. Understand casting solidification phenomenon and influencing thermal parameters
7. Apply the modulus approach for identifying the last solidifying region

COURSE CONTENTS

Unit 1

Foundry: Selection of pattern materials, Pattern allowances, Molding sand & their properties, testing of molding sand, cores and chaplets, casting defects & remedies. Special Casting Techniques: Gravity die or permanent mould casting, Pressure die casting, CO_2 molding, Investment mould casting, shell molding, centrifugal casting and continuous casting, Introduction to gating and feeding system

Unit 2

Welding: Classification of processes, power sources, characteristic curves, welding parameters of MMAW, electrode classification and their nomenclature, TIG welding, MIG welding, Submerged arc welding and atomic hydrogen welding processes, Theory of resistance welding and various processes. Welding of materials: Parameters & processes used in welding of mild steel, alloy steel, stainless steel and Aluminium alloys, Welding Defects and remedies.

Unit 3

Hot Working of Metals: Rolling principle and rolling stand arrangements, forging operations, drop, press and machine forgings, forging defects, extrusion principles, hot extrusion processes. Cold working of metals: Shearing, blanking and punching, tube drawing, wire drawing, squeezing, cold rolling, forging and bending operations.

Unit 4

Linear & angular measurement, Comparator, Slip gauges, angle gauges, sine bar, auto-colimeter, screw thread and gear measurement, measurement of straightness, flatness & squareness.

Unit 5

Limits, fits and tolerances. Interchangeability, types of fits, allowances, hole & shaft basis system, standard limit system, tolerance & fundamental deviation, gauges & gauge design. Acceptance test, and alignment test for lathe, milling, shaping & drilling machines. Surface texture, Interferometry, Coordinate measuring machine & Toolmaker's microscope.

Text Books:

1. Rao P. N., Manufacturing Technology.
2. Lindberj, Manufacturing Process.
3. Campbell, Principles of Manufacturing materials & Process.

References Books:

1. Parmar R. S., Welding Processes and Technology.
2. Jain P. L., Principle of Foundry Technology

CODE	SUBJECT NAME	L	T	P	Credits			Maximum Marks				
					T	P	Total	Th.	CW	SW	Pr.	Total
ME 26881	Machine Drawing & Computer Graphics	-	-	2	-	1	1	-	-	40	60	100

Pre-requisites: ME 10149

Course Assessment:

The following methods are adopted for the assessment of this course;

1. **Sessional Work** (40 marks) on the basis of internal viva and continuous laboratory journal assessment and laboratory attendance.
2. **Practical Examination** (60 Marks) on the basis of evaluating practical knowledge, quiz and viva-voce.

Course Outcomes:

CO1	Develop the skill of drafting using CAD software
CO2	Understand standard drawing conventions and practices
CO3	Represent surface finish and tolerances of machine elements in drawing.
CO4	Draw the machine elements like couplings, cotters, riveted, bolted and welded joints.
CO5	Prepare an assembly drawing using part drawings of machine components.

COURSE CONTENTS

Unit 1

Introduction to computer aided drafting. Basic commands of common computer aided drafting packages for 2-D & 3-D. Machine Drawing practice with CAD software

Unit 2

Sectioning and drawing conventions for types of threads, welded joints, Surface roughness value and grade. Fits and tolerances- symbols and applications, Dimensioning, Use of standards and codes (BIS, ISO etc.)
Orthographic projections of simple machine parts such as threaded fasteners, pulleys, keys, cotters, pins etc.

Unit 3

Types of assembly drawings, norms and sequences of preparing assembly drawings
Orthographic projections of Nut-Bolt-Washer assembly, Riveted joints, cotter joint, knuckle joint, flanged coupling, universal coupling, Oldham's coupling. Pipe joints.

Unit 4

Bearings: Bushed bearing, Plummer block, foot step bearing.
Engine parts like piston, connecting rod, eccentric, and crankshaft.

Unit 5

Types of valves like ball valve, flap valve, stop valve, feed check valve, safety valves, blow off cock, tool post.

NOTE: *Each candidate should complete himself at least four full imperial size sheets during the semester*

Text Books:

1 Bhatt N.D. and Panchal V.M., Machine Drawing, Charotar Publishing House, 2000
2 K L Narayana, P Kannaiah, K Venkata Reddy, Machine Drawing, New Age International Publication, 2014

References Books:

1 IS Code: SP 46 – 2003, Engineering Drawing Practice
2 Laxminarayan and Mathur, Machine Drawing, Jain Bros, New Delhi, 1983