3rd Semester Mechanical Engineering

Course No.	*Course Name*	*Credits*	*L*	*T*	*P*
MEC 301	Fundamental Dynamics	3	2	1	0
MEC 302	Mechanics of Materials-I	4	3	1	0
MEC 303	Fluid Mechanics	3	2	1	0
MEC 304	Engineering Thermodynamics	3	2	1	0
MEC 305	Manufacturing Technology	3	2	1	0
MEC 306	Engineering Graphics & Computer Modelling	3	0	0	6
MTH 304	Mathematics	3	2	1	0
MEC 302P	Mechanics of Materials -I Lab.	1	0	0	2
MEC 303P	Fluid Mechanics Lab.	1	0	0	2
MEC 305P	Manufacturing Technology - I Lab.	1	0	0	2
	Total of Credits & LTP	**25**	**13**	**6**	**12**

Course No.: MEC 301 FUNDAMENTAL DYNAMICS C L T (3 2 1)

COURSE OUTCOMES:

1. Understand the Concepts of dynamics and various laws of Dynamics.
2. Understand methods of solving dynamics mechanical problems and their suitability for applications.
3. Calculate the motion characteristics of a body subjected to a given dynamics force system
4. Understand the Three-Dimensional Dynamics of rigid bodies and the gyroscopic effects in ships, aero planes and road vehicles.

UNIT I

Kinematics of Particles: Introduction, Rectilinear Motion, Plane Curvilinear Motion , Rectangular coordinates (x-y), Normal and Tangential coordinates (n-t), Polar coordinates (r-θ), Space curvilinear Motion, Relative Motion, Constrained particle Motion. (Vectorial approach to be adopted)

UNIT II

Kinetics of Particles: Review of Force, Mass, Acceleration, Impulse, Momentum, Work and Energy, Linear impulse and linear momentum, Angular impulse and angular momentum, Impact, Central- Force and motion, and relative motion.

Kinetics of Systems of Particles: Introduction, Generalised Newton's second law, Work-Energy, Impulse-Momentum, Conservation of Energy and Momentum, Steady Mass Flow, Variable mass

UNIT III

Plane Kinematics of Rigid Bodies: Introduction, Rotation, Absolute Motion, Relative velocity, Instantaneous center of zero velocity, Relative acceleration, Motion relative to rotating axes.

Plane Kinetics of Rigid bodies: Introduction, General equation of Motion, Translation, Fixed axis rotation, General plane motion, Work energy relations, acceleration from work-energy; virtual work, Impulse-Momentum equation.

Text Book:

1. Meriam, J.L., Kraige, L.G., "Engineering Mechanics: Vol.2, Dynamics". S.I., Version, *John Wiley & Sons Inc.,1996.*

Reference Book:

1.Hibbeler, R.C., "Dynamics", *Prentice Hall, N.Jersy , USA, 2000.*

Course No.: MEC 302 **MECHANICS OF MATERIALS -I** **C L T (4 3 1)**

COURSE OUTCOMES:

1. Explain stress-strain, relate &evaluate them for different planes in structural members subjected to various loading conditions.
2. Compute deformation in pressure vessels.
3. Describe various theories of failure, compare them & propose the appropriate one for particular material/situation.
4. Estimate bending stresses & deflection of beams/columns under various loading/end conditions.

UNIT I

General concepts: Free body diagram, section forces in beams, general concepts of stress and strain, stresses on inclined plane in an axial member, strain displacement equation, compatibility conditions, statically indeterminate structures, thermal effects.

Analysis of stress and strain: Three dimensional states of stress, Mohr's circle, Cauchy's formula, principal stresses and principal planes, three dimensional state of strain, principal strains and principal axes, Generalized Hook's law, elastic constants and their relationships, measurement of strain, strain energy.

Pressure Vessels: Stresses and strains in thin cylindrical and spherical shells, thick cylinders, Lame's theory, radial deflection, compound cylinder, effective proportions, laminated cylinders.

UNIT II

Introduction to mechanical properties of solids: Stress – strain diagrams, resilience, hardness, impact strength. Symmetric beam bending: The elastic flexural formula and applications, built-up and composite beams. Integration method of solution, Macaulay's method of solution, Area moment method, Statically indeterminate beams, Conditions for indeterminacy, Energy methods for beams, strain energy and complementary strain energy.

UNIT III

Theories of Elastic Failures: Various theories of elastic failure, significance of the theories of failure, comparison and graphical representation.

Columns: Concept of elastic stability, Euler's theory of buckling of columns, eccentric loading, short columns.

Torsion: Torsion of circular shafts, comparison between hollow & solid shafts, tapered circular shafts, torsion of thin circular tubes, statically indeterminate shafts.

Text Books:

1. Popov, E.P., Balan, T.A, "Mechanics of Solids", *Prentice Hall of India, N.Delhi, 2007.*
2. Shames, I.H., Pitaresi, J.M., "Introduction to Solid Mechanics" *Prentice Hall of India. EEE,* 2006.
3. Kazmi, S.M.A, "Solid Mechanics", *Tata Mc-Graw Hill, 1998.*

Reference Books:

1. Fung, Y.C., "Foundations of Solid Mechanics", *Prentice Hall of India, 1968.*
2. Hearn, E.J., "Mechanics of Materials", Vol. I, *Pergamon press, 1989.*

Course No.: MEC 303 **FLUID MECHANICS** **C L T (3 2 1)**

COURSE OUTCOMES:

1. Apply conservation laws to fluid flow problems in engineering applications.
2. Design experimental procedure for physical model studies.
3. Compute drag and lift coefficients using the theory of boundary layer flows.
4. Analyze and design free surface and pipe flows.

UNIT I

Introductory definitions, fluids, types of fluids, Continuum approach to stress, Fluid properties, Fluid at rest, Pascal's law, Barometers, Manometers, Hydrostatic pressure thrusts, Buoyancy, Flotation, Stability, Scalar and velocity fields, Flow field and description of fluid motion

UNIT II

Continuity equation, Momentum equation, Energy equation, Euler's equation, Bernoulli equation, Ideal fluids, Navier-stokes equations, exact solutions, Laminar boundary layer, boundary layer equations, Blausius flow, momentum-integral equation of boundary layer

UNIT III

Turbulent flow, Laminar-Turbulent Transition, Fluctuations, Turbulent boundary layer equations, Shear stress models, Universal velocity distribution law, pipe flow, friction factor, fully developed pipe flow, pipe bends, pipe losses, Dimensional homogeneity, Raleigh methods, Buckingham's theorem, typical non dimensional parameters, Geometric, kinematics and dynamics similarity, model testing.

Text Book:

1. White , F.M., "Fluid Mechanics", *Mc-Graw Hill, 2001.*

Reference Books:

1. Munson, B.R., "Fundamental of Fluid Mechanics", *John Wiley, 2002.*

2. Cengal Y., "Fluid Mechanics", *McGraw Hill, 200*

Course No.: MEC 304 **ENGINEERING THERMODYNAMICS** **C L T (3 2 1)**

COURSE OUTCOMES:

1: Develop the concept of basic laws of thermodynamics and thermodynamics systems.
2: Apply and analyze First & Second Law of Thermodynamics.
3: Apply the concept of Carnot cycle on heat engine & heat pumps.
4: Develop the basic knowledge of thermodynamics relation.

UNIT I

Introduction and historical development, Microscopic and macroscopic views of matter, Thermodynamic systems, properties, processes, cycles, thermal equilibrium, Zeroth law of thermodynamics, temperature, thermodynamic equilibrium, Energy and the first law, Mechanical concept of energy, internal energy, conservation of energy, energy transfer as work, various modes, energy transfer as heat, First law for closed system, The state postulate, pure substance, simple compressible substances, specific heat, isothermal, isobaric, isentropic compressibility.

UNIT II

First law for open systems , enthalpy, first law for cyclic processes, applications, Second law of Thermodynamics, Entropy and second law, Thermodynamic reservoirs, various statements and their equivalence, reversible cycle, Carnot cycle, efficiencies of reversible cycle, Carnot's theorem, Thermodynamic temperature scale, Clasius's theorem, entropy concept, inequality of Clasius's principle's of increase of entropy and its applications, Second law for closed system , Second law for open system.

UNIT III

Energy, Gibb's function, Helmholtz function, Relationship between specific heats, Clapeyron equations, thermodynamic relations for ideal gases (computation of entropy and internal energy from measurable quantities, Process with ideal gases and vapours, Calculations involving heat transfer, work transfer and change in thermodynamic properties with various processes, Ideal gas mixture, various definitions, Dalton's law, Gibb's – Dalton's law, Amagat - Leduc law, internal energy, enthalpy, specific heat and entropy of an ideal gas mixture, air water vapour mixture**,** Complete and incomplete combustion analysis, heating value of fuels, analysis of products of combustion, Orsat apparatus.

Text Books:

1. Moran, M.J., Shapiro, "Fundamentals of Engineering Thermodynamics", *John Wiley, 2005.*
2. Wark, K., "Thermodynamics", *Mc-Graw Hill, 2001*.

Reference Books:

1. Cengal, Y., Boles, "Thermodynamics", *Mc-Graw Hill, 2001.*
2. Van-Wylen, G.J., "Fundamentals of Classical Thermodynamics", *John Wiley, 2001*

Course No.: MEC 305 **MANUFACTURING TECHNOLOGY** **C L T (3 2 1)**

COURSE OUTCOMES:

1. Analyze the application of various casting processes in manufacturing domain
2. Understand the basics of metal cutting with reference to different types of machine tools.
3. Explain the conventional and advanced metal forming processes.
4. Analyze the importance of welding processes in manufacturing domain and apply knowledge to select appropriate welding process based on the type of industrial application

UNIT I

Introduction to basic manufacturing processes and engineering materials, Casting terminologies, solidification, expendable mould casting processes, patterns and risers, investment casting and plaster mould castings, die casting , centrifugal casting. Introduction to metal cutting, machining processes and machine tools. Orthogonal machining, Cutting forces, shear plane angle, Ernst Merchant theory, mechanics of metal cutting. Tool life equation. Lathe parts and turning operations, Cutting tool nomenclature, tool materials, tool wear. Various machine tools and operations.

UNIT II

Metal Forming : fundamentals of metal forming , independent and dependent variables, hot working and cold working , warm forming, rolling. Forging and various types of forging, extrusion and various types of extrusion. Introduction to various press work operations, press working dies, shearing load and press selection, spinning, High energy rate forming, explosive forming, Electromagnetic forming and its applications, Fabrication of composites.

UNIT III

Welding: Introduction to welding, types of welding. Welding machines, Shielded Metal Arc Welding (SMAW) process, Gas Metal Arc Welding(GMAW) process, Gas Tungsten Arc Welding (GTAW) process, Shielded Arc welding (SAW) process, Resistance welding, Seam, Spot and Flash butt welding, Ultrasonic welding, Laser beam welding, Automation in welding and various defects.

Text Book:

1. Degarmo, E.P., Black, J.T. and Kohser, R.A., "Materials and Processes in Manufacturing", *Prentice Hall of India, 2005.*

Reference Books:

1. Serop, K., Steven, R.S., "Manufacturing Processes for Engineering Materials", *Prentice Hall of India,1998.*

Course No.: MEC 306 ENGINEERING GRAPHICS & COMPUTER MODELLING

C L P (3 0 6)

COURSE OUTCOMES:

1. Classify the various principles of engineering drawing and examine CAD for 2D and 3D modelling.
2. Design and analyze the assembly modelling and surface modelling of machine components.
3. Ability to modify the developed assembly model for machine components.
4. Evaluation of designed components and thereby procuring the knowledge of new product development.

UNIT I

Introduction to CAD, Theory of general engineering design, conceptual design, embodiment design involving layout and form designing to standard, geometrical modelling: basic sketching, lines and arcs, extrude and revolve features.

UNIT II

Extrude cut and fillets, solid modelling of Oldham's coupling components, surface modelling, merging of surfaces, assembly modelling, assembly modelling of Oldham's coupling, machine elements.

UNIT III

Tailstock components and assembly of tailstock components, components of globe valve, assembly of globe valve components of butterfly valve, assembly of butterfly valve, Introduction to animation, Mini Project.

Text Books:

1. Bhat, N.D., "Machine Drawing", *Charotar Publishing House Pvt. Ltd*., 2008.
2. Gill, P.S., "Machine Drawing", *Kataria and Sons, New Delhi, 2008.*

Reference Book:

Zeid I., "CAD/CAM Theory & Practice", *Tata Mc-Graw Hill, New Delhi, 2008*

Course No.: MTH 304 **MATHEMATICS** **C L T (3 2 1)**

COURSE OUTCOMES:

1. Evaluate the Laplace transforms of the functions.
2. Apply Laplace transforms for solving ordinary differential equations.
3. Solve problems related to analytic functions, complex integration, Taylors theorem, zeroes and poles of analytic functions
4. Evaluate Fourier transforms of the functions.
5. Able to apply Fourier transforms for solving Integral equations, partial differential equations.

UNIT 1

Laplace transform, shifting theorem, Laplace transforms of derivatives and integrals, Heaviside's unit function. Dirac Delta function and its Laplace transforms. Laplace transforms of periodic functions, Heaviside's expansion theorem, Inverse Laplace transforms, initial and final value theorems.

UNIT II

Convolution theorem and its applications, use of Laplace transforms in the solution of linear differential equations.

Complex variables, analytic functions, Cauchy Riemann equations, Complex integration, Cauchy's fundamental theorem, Cauchy's integral formula, Cauchy's inequality and Liouville's theorem on integral function.

UNIT III

Taylor's & Laurent's expansions, Zeros & poles of analytic functions, Residues. Fourier series, Harmonic analysis, Definition of Fourier transform. Fourier sine and cosine transform. Fourier integral formula and its applications to solution of boundary value problems.

Reference Books:

1. Spiegel, "Laplace transform", *Schaum series,* Snedden, I.N., " The use of Integral Transform", *Tata McGraw Hill, New Delhi, Year.*
2. Loknath, Debnath, "Integral Transforms" *CR C Press, New York, USA.*

Text Books:

1. Churchill,R.V., "Complex Variables and Applications", *McGraw Hill*
2. Titchmarsh, E.C., "Theory of functions", *Academic University Press.*

MEC 302P **MECHANICS OF MATERIALS –I LAB.** **C P(1 2)**

COURSE OUTCOMES:

1. Identify different engineering materials, describe their properties & predict their behaviours under different types of loadings.
2. Compute the stresses, strains, moments, deflections etc. & examine the expression used.
3. Compare sizes & sections of various materials for different structural members such as beams, shafts, columns etc. & justify the selection.
4. Determine the mechanical properties of materials by destructive methods.

1. Tensile test of mild steel and aluminium bars.
2. Shear test on specimen of two different metals.
3. Bending tests on a steel bar/wood.
4. Impact tests on metals: a) Izod Test; b) Charpy Test
5. Torsion test on specimen of different metals for determining the angle of twist for a given torque.
6. Hardness tests on metal to determine Brinell and Rockwell hardness.
7. Buckling load for a column.
8. Compressive test of a specimen.

MEC 303P **FLUID MECHANICS LAB.** **C P(1 2)**

COURSE OUTCOMES:

1. Develop procedure for standardization of experiments.
2. Calibrate flow discharge measuring device used in pipes channels and tanks.
3. Determine fluid and flow properties.
4. Characterize laminar and turbulent flows.

1. To determine the Viscosity of a fluid by falling sphere (ball) viscometer.
2. Critical Reynolds number in pipe flow.
3. Verification of the Bernoulli's theorem.
4. To find coefficient of discharge for Venturi meter.
5. Calibration of a Rotameter.
6. Measurement of velocity in the wind tunnel with pitot static tube.
7. Measurement of pressure with pressure sensors.
8. Flow visualisations past bluff and streamline bodies in a smoke tunnel.
9. Calculation of flow rate using an orifice meter.

MEC305P **MANUFACTURING TECHNOLOGY-I LAB.** **C P(1 2)**

COURSE OUTCOMES:

1. Describe the geometry of single point cutting tool and the effect of geometrical features on machining performance and quality
2. Apply knowledge of metal cutting to perform various machining operations.
3. Explain the working and use of various components of conventional machine tools.

1. Testing moulding sand for permeability, shear strength and compression strength.
2. Percentage of cross- sectional area reduction by rolling and wire drawing.
3. SMAW, welding parameters selection for MS strips.
4. Study of lathe machine.
5. Performing step turning and taper turning on lathe machine.
6. Performing drilling and boring operations on lathe machine.
7. Performing external thread cutting on lathe machine.
8. Study of bench type drilling machine.
9. Performing various operations like drilling, reaming, counter boring and countersinking on drilling machine.
10. Study of a surface grinding machine. Performing surface grinding on washers.
11. Study of dividing head and performing gear milling.