Course Code	**ESC_ME301**				
Category	**Engineering Science Courses**				
Course Title	**Fundamentals of Dynamics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	2	**1**	**0**	**3**	
Pre requisites	**Engineering Mechanics-statics, Engineering Physics, Engineering Mathematics**				

Objectives:

To provide an introductory treatment of Engineering Mechanics (Dynamics) to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters

M.No:	**Topic**	**No. of Hrs**
Module 1.	Kinematics of rigid bodies- translation and fixed axis rotation, general plane motion- velocity, instantaneous center of rotation, general plane motion- acceleration, analyzing motion with respect to a rotating frame, motion of a rigid body in space, motion (velocity and acceleration) relative to a moving reference frame.	8
Module 2.	Planar kinetics of a rigid body- equations of motion for a rigid body, angular momentum of a rigid body in plane motion, plane motion of a rigid body, kinetic energy, the work of a force, the work of a couple moment, principle of work and energy, conservation of energy, impulse and momentum- linear and angular momentum, principle of impulse and momentum, systems of rigid bodies, conservation of momentum, eccentric impact, solution of problems involving the motion of a rigid body, systems of rigid bodies, constrained plane motion.	12
Module 3.	Three-dimensional kinematics of a rigid body- rotation about a fixed point, the time derivative of a vector measured from either a fixed or translating-rotating system, general motion, relative motion analysis using translating and rotating axes.	10
Module 4.	Three-dimensional kinetics of a rigid body- angular momentum of a rigid body in three dimensions, applying the principle of impulse and momentum to the three-dimensional motion of a rigid body, kinetic energy of a rigid body in three dimensions, rate of change of angular momentum, Euler's equations of motion, motion of a rigid body about a fixed point, rotation of a rigid body about a fixed axis, equations of motion of a gyroscope, Eulerian angles, steady precession, motion of an axisymmetric body under no force.	12
Total number of Hours		**42**

Course Outcomes:

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

- ***Apply*** fundamental concepts of kinematics and kinetics of rigid bodies to the analysis of simple, practical problems **(L3).**
- ***Apply*** basic knowledge of maths and physics to solve real-world problems **(L3).**
- ***Understand*** basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts) **(L2).**
- ***Understand*** and be able to ***apply*** Newton's laws of motion **(L2, L3).**

S.No:	**Text Books**	**Author**	**Publisher**
1.	Engineering Mechanics: Dynamics	Anthony Bedford and Wallace Fowler	Pearson
	References		
1.	Engineering Mechanics: Statics and Dynamics	R.C Hibbeler	Pearson
2.	Engineering Mechanics: Dynamics	J.L Meriam and L.G Kraige	Wiley

3.	Vector Mechanics for Engineers: Statics and Dynamics	Ferdinand P. Beer E. Russell Jhonston	McGraw Hill Education

---

Course Code	**PCC_ME302**				
Category	**Professional Core courses**				
Course Title	**Computer Aided Machine Drawing (CAMD)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	2	**0**	**2**	**3**	
Pre requisites	**Engineering Drawing, Computer Aided Drawing**				

Objectives:

To create drawings in either 2*d*/ 3*d* inorder to visualize the construction of machine parts. and to assemble and disassemble various machine components for clear visualization.

M.No:	**Topic**	**No. of Hrs**
Module 1.	Assembly drawing of different couplings- rigid coupling, muff, flanged, non-aligned couplings universal coupling, oldham's coupling.	08
Module 2.	2d drawings of bearings - solid, bushed and pedestal (plummer block).	08
Module 3.	Assembly drawing of automobile parts - connecting rod, piston and clutch.	10
Module 4.	Assembly drawings of parts and accessories - screw jack, pipe joints (flanged type hydraulic joint).	06
Module 5.	Introduction of solid modelling, various components/ parts of machine elements using 3d modelling software (Solid Works/ Autodesk Inventor) *such as*, nut and bolt, universal joint, cotter joint, gears (spur gear).	10
Total number of Hours		**42**

Course Outcomes:

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

- ***Understand*** various creating and editing commands in CAD softwares **(L2).**
- ***Understand*** the advantages of using CAD in comparison with conventional methods of drawing.
- ***Interpret*** the object with the help of given sectional and orthographic views **(L5)**.
- ***Draw*** machine element using keys, cotter, and bolted joints **(L3)**
- ***Assemble*** details of any given part. i.e. engine parts, Gears , Bearings etc **(L6)**.

S.No:	**Text Books**	**Author**	**Publisher**
1.	Textbook of Machine Drawing	K.C John	Prentice Hall India Learning Private Limited
2.	Computer Aided Machine Drawing	R Gopala Krishna, A S Ravindra	Subhas Stores
	References		
1.	Machine Drawing	N. D. Bhat, V. M. Panchal	Charotar Publishing House
2.	Machine Drawing	K. L. Narayana	New Age International Publishers
3.	Machine Drawing	P. S. Gill	S.K. Kataria & Sons

Course Code	**PCC_ME303**				
Category	**Professional Core Courses**				
Course Title	**Materials Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	2	**1**	**0**	**3**	
Pre requisites	-				

Objectives:

To give basic knowledge of science behind materials & physical metallurgy. Introduce the concept of structure property relations and to give students a feel of how material science is useful in engineering practices.

M.No:	**Topic**	**No. of Hrs**
Module 1.	Introduction to material science and engineering. importance of material science and engineering, classification of materials, modern and advanced materials, human needs and materials selection and design considerations, primary bonds and secondary bonds, energy related concepts, concept of unit cells and lattice arrangements, metallic crystal structures (*FCC, BCC, HCP*), crystal systems, crystallographic directions and planes, single crystals. polycrystalline materials. anisotropy, non-crystalline solids.	10
Module 2.	Theoretical density computations, atomic densities (linear and planar), polymorphism and allotropy, ceramic crystal structures, polymer structure. thermoplastic and thermosetting polymers, *X*-ray diffraction and determination of crystal structures.	10
Module 3.	Imperfections in solids. point defects, line defects and volume defects. grain size determination. diffusion mechanism, diffusion in solids, steady state diffusion, non steady state diffusion, factors that influence diffusion	10
Module 4.	Deformation of metals, concept of stress strain, elastic deformation, plastic deformation. hardness, deformation mechanism, slip systems. plastic deformation of polycrystalline metals, deformation by twinning, strengthening mechanisms, strengthening by grain size reduction, solid solution strengthening, strain hardening. recovery, recrystallization, grain growth, heat treatment processes, phase, solubility limit, phase diagrams, microstructure and phase equilibria, unary phase diagrams, binary phase diagrams, interpretation of phase diagrams, iron carbon system, development of microstructure in iron carbon alloys, introduction to creep & fatigue.	12
Total number of Hours		**42**

Course Outcomes:

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

- ***Understand*** the crystal structures, crystallographic planes, directions, and voids in metallic materials **(L2)**.
- ***Develop*** knowledge of imperfections in crystalline solids, plastic deformation and strengthening mechanisms in metals **(L6).**
- ***Acquire*** knowledge about deformation and strengthening mechanisms in metals **(L3).**

S.No:	**Text Books**	**Author**	**Publisher**
1.	Fundamentals of Materials Science and Engineering	Callister. W.D	John Wiley & Sons, 2011
	References		
1.	Physical Metallurgy	Cahn. R.W., Haasen. P	North-Holland, 1991
2.	Mechanical Metallurgy	George E. Dieter	McGraw Hill

Course Code	**PCC_ME303L**				
Category	**Professional Core Courses**				
Course Title	**Materials Engineering Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	0	**0**	**2**	**1**	
Pre requisites					

M.No:	**Topic**
Module 1.	To study 2D & 3D lattices.
Module 2.	To study crystal structures using appropriate models.
Module 3.	To study Bravais Lattices using appropriate models.
Module 4.	To study crystal imperfections using appropriate models.
Module 5	To study three dimensional close packing using appropriate models.
Module 6.	Specimen preparation for micro structural examination.
Module 7.	To study microstructure of metals/alloys.
Module 8.	To study Heat Treatment Processes of steel.
Module 9.	To study creep behaviour of a given specimen(*e.g.* lead, zinc, solder wire).

Course Code	**PCC_ME304**				
Category	**Professional Core Courses**				
Course Title	**Basic Engineering Thermodynamics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	2	**1**	**0**	**3**	
Pre requisites	**None**				

Objectives:

To understand various gas laws and equations of state and apply them to solve problems of estimating enthalpy, entropy, specific heat and internal energy and to use the various Laws of Thermodynamics to estimate the potential for thermo-mechanical energy conversion in aerospace power and propulsion systems.

M. No:	**Topic**	**No. of Hrs**
Module 1.	Basic concepts- the concept of continuum, macroscopic approach, thermodynamic systems, and their properties, state, path, process and cycle, quasistatic process, Zeroth law of thermodynamics, the concept of temperature and heat, thermometry and temperature scales, energy transfer.	06
Module 2.	Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, *P-V, P-T, T-V, PVT* surfaces, gas mixtures – properties ideal and real gases, equation of state, Avogadro's law, Van Der Waals equation of state, compressibility factor, compressibility chart, Dalton's law of partial pressure.	07
Module 3.	First law of thermodynamics- concepts of internal energy, specific heat capacities, enthalpy, energy balance for closed and open systems, steady-flow engineering devices.	07

Module 4.	Second law of thermodynamics- Kelvin Planck and Clausius statements, heat engines, carnot theorem, Carnot cycle, the thermodynamic temperature scale, refrigerator and heat pump.	07
Module 5.	Clausius inequality, concept of entropy, principle of increase of entropy, reversible and irreversible processes, entropy change of pure substances, property diagrams (*T-S, H-S* diagrams), the entropy change of ideal gases, reversible steady-flow work. exergy analysis, second law efficiency.	10
Module 6.	Exact differentials, *T-D* relations, Maxwell's relations. Clausius Clapeyron equations, Joule –Thomson coefficient.	05
Total number of Hours		**42**

Course Outcomes:

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

- ***Describe*** basic concepts of thermodynamics such as system, state, state postulate, equilibrium, process, and cycle **(L1).**
- ***Review*** concepts of temperature, temperature scales, pressure, and absolute and gauge pressure **(L1)**.
- ***Define*** the concept of heat and work and transfer of energy by heat and work **(L1).**
- ***Judge*** the properties of pure substances **(L5).**
- ***Illustrate*** the *P-v, T-v*, and *P-T* property diagrams and *P-v-T* surfaces of pure substances **(L4).**
- ***Demonstrate*** the procedures for determining thermodynamic properties of pure substances from tables of property data **(L3).**
- ***Describe*** and ***apply*** the ideal-gas equation of state in the solution of typical problems **(L2, L3).**
- ***Identify*** the first law of thermodynamics as simply a statement of the conservation of energy principle for closed systems and ***formulate*** the general energy balance applied to closed systems via heat and work transfer **(L1, L6)**.
- ***Apply*** the first law of thermodynamics to the open systems **(L3).**
- ***Describe*** the Kelvin–Planck and Clausius statements of the second law of thermodynamics.and ***assess*** its thermodynamic applications **(L1, L5).**
- ***Examine*** the Carnot heat engines, refrigerators, and heat pumps and ***determine*** their expressions for the thermal efficiencies and coefficients of performance **(L4, L3).**
- ***Define*** a new property called entropy to quantify the second law effects **(L1).**
- ***Develop*** the isentropic efficiencies for various steady-flow devices **(L6)**.
- ***Define*** the maximum useful work obtained from the system **(L1).**
- ***Generate*** mass and energy balance equations for gas-vapor mixtures **(L6)**.

S.No:	Text Books	Author	Publisher
1.	Engineering Thermodynamics	Nag.P.K.	Tata McGraw-Hill
	References		
1.	Thermodynamics, An Engineering Approach	Cengel,	Tata McGraw-Hill
2.	Fundamentals of Engineering Thermodynamics	Moran, J. Shapiro, H. N., Boettner, D. D., & M. Bailey	John Wiley & Sons.
3.	Fundamentals of Thermodynamics	R. E. Sonntag, C. Borgnakke, & G. J. V Wylen.	John Wiley & Sons.

Course Code	**PCC_ME305**				
Category	**Professional Core Courses**				
Course Title	**Manufacturing Technology-I**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	2	**1**	**0**	**3**	
Pre requisites	**Basic knowledge of material science, fluid mechanics and heat transfer.**				

Objectives:

To emphasize the importance of manufacturing sciences in day-to-day life, and to study the basic manufacturing processes, tools and various conventional manufacturing processes like casting, metal forming process *etc*.

M.No:	**Topic**	**No. of Hrs**
Module 1.	Introduction, manufacturing cycle, manufacturing processes and their selection, engineering materials and their selection.	03
Module 2.	Casting- patterns, gating system design, riser design, defects, other casting processes- investment, die casting, centrifugal and continuous casting, basic design considerations in casting.	10
Module 3.	Metal forming- plastic deformation, hot and cold working, forming operations-rolling, extrusion, drawing processes, sheet metal operations, sheet metal die design, high velocity forming processes, heat treatment processes.	12
Module 4.	Processing of plastics- extrusion, injection moulding, blow moulding, rotational moulding, thermo-forming and compression moulding, processing of polymer matrix composites & applications.	13
Module 5.	Powder metallurgy processing- production of metal powders, compaction and sintering processes.	04
	Total number of Hours	**42**

Course Outcomes:

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

- ***Select*** suitable manufacturing processes to manufacture the products optimally **(L1).**
- ***Recommend*** the appropriate design of gating systems, forming processes **(L5).**.
- ***Develop*** simplified manufacturing processes with the aim of reduction of cost and manpower **(L6).**
- ***Identify*** the appropriate process parameters, and possible defects of manufacturing processes so as to remove them **(L1).**

S.No:	**Text Books**	**Author**	**Publisher**
1.	Manufacturing Science	Amitabha Ghosh, Asok Kumar Mallik	East-west press pvt ltd
2.	Manufacturing Technology. Tata	P N Rao.	McGraw-Hill Publishing Co. Ltd., New Delhi.
	References		
1.	Manufacturing Engineering and Technology.	S Kalpakjian.	Addison-Wesley (India).
2.	Materials and Processes in Manufacturing.	E P DeGarmo, J T Black and R Kosher.	Macmillan International.

Course Code	**PCC_ME305L**				
Category	**Professional Core Courses**				
Course Title	**Manufacturing Technology-I Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	0	**0**	**2**	**1**	
Pre requisites	**Basic knowledge of material science, fluid mechanics and heat transfer.**				

M. No:	**Topic**
Module 1.	Testing molding sand for permeability, shear strength and compressive strength.
Module 2.	Prepare a mould for sand casting for a given pattern.
Module 3.	Prepare a Plastic product using injection Molding machine.
Module 4.	Prepare a wooden split pattern.
Module 5.	Perform dye penetrant test for inspection of casted product.
Module 6.	Study and observe the plain and grooved Rolling techniques through demonstration.
Module 7	Study and observe the Powder Metallurgy techniques through demonstration.

Course Code	**PCC_ME306**				
Category	**Professional Core Course**				
Course Title	**Fluid Mechanics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	3	**1**	**0**	**4**	
Pre requisites	**Engineering Mechanics, Engineering Physics**				

Objectives:

To introduce and explain fundamentals of Fluid statics, kinematics and dynamics, which is used in the applications of aerodynamics, hydraulics, marine engineering, gas dynamics etc.

M. No:	**Topic**	**No. of Hrs**
Module 1.	Definitions, fluids, types of fluids, continuum approach to stress, fluid properties, fluid statics, pressure distribution in hydrostatics, manometers.	11
Module 2.	Forces on plane and curved surfaces, buoyancy and the concept of stability of floating and submerged bodies.	07
Module 3.	Scalar and vector fields, Eulerian and Lagrangian approaches, velocity and acceleration, streamline, streak line and path line, deformation, rotation and vorticity, circulation.	07
Module 4.	Continuity equation, momentum equation, energy equation, Euler's equation, Bernoulli equation and applications, Navier-Stokes equations, exact solutions.	12
Module 5.	Pipe flow, friction factor, fully developed pipe flow, pipe bends, pipe losses, Hydraulic grade line.	06
Module 6.	Laminar boundary layer, boundary layer equations, momentum- integral equation of boundary layer, Introduction to laminar-turbulent transition, dimensional analysis and model testing.	09
Total number of Hours		**52**

Course Outcomes:

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

- ***Define*** fluid and its properties, ***Explain*** Newton's law of viscosity **(L1,L2).**
- ***Understand*** Newton's law of viscosity and ***Classify*** fluids based on Newton's law of viscosity **(L2)**
- ***Apply*** the principle of manometry to measure gauge and differential pressure, stability of floating bodies and to determine metacentric height **(L3)**.
- ***Analyze*** and **calculate** Hydrostatic Force and its Location for a plane surface *etc* **(L4)**
- ***Understand*** the concept of Eularian and Lagragian approaches of fluid motion, vector and acceleration field **(L2)**.
- ***Analyze*** the streamline, pathlines and streakline **(L4)**.
- ***Apply*** concepts of mass, momentum and energy conservation to flows **(L3).**
- ***Understand*** Navier-Stokes equation and ***apply*** for simple one/ two dimensional pipe flow/ flow through parallel plates **(L2, L3)**
- ***Apply*** Bernoulli's equation for real flow and ***deduce*** expressions for orifice meter and Venturimeter **(L3, L4)**.
- ***Understand*** major and Minor losses **(L2)**
- ***Analyze*** Darcy-Weichbach equation to calculate friction losses **(L4).**
- ***Understand*** boundary layer flow and flow past immersed bodies the basic ideas of turbulence **(L2).**

S.No:	Text Books	Author	Publisher
1.	Introduction to Fluid Mechanics and Fluid Machines	S K Som, Gautam Biswas,S Chakraborty	McGraw Hill Education;/ 3rd edition/ 2017
2.	Fluid Mechanics	Robert. W. Fox	John Wiley
	References		
1.	Fundamental of Fluid Mechanics	Munson. B.R	John Wiley
2.	Introduction to Fluid Mechanics	Cengel. Y	McGraw Hill
3.	Fluid Mechanics	White. F.M	McGraw-Hill

Course Code	**PCC_ME306L**				
Category	**Professional Core Courses**				
Course Title	**Fluid Mechanics Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- 3 (Three)**
	0	**0**	**2**	**1**	
Pre requisites	**Engineering Mechanics, Engineering Physics**				

Objectives:

To discuss and practice standard measurement techniques of fluid mechanics and their applications. To determine the various parameters related to fluid flow in pipes and to correlate various flow measuring devices such as Venturimeter, orifice meter and notches etc.

M.No:	Experiments
Module 1.	Measurement of viscosity.
Module 2.	Study of pressure measuring devices.
Module 3.	Determination of metacentric height.
Module 4.	Hydrostatics force on flat surfaces/ curved surfaces.
Module 5.	Verification of Bernoulli's theorem.
Module 6.	Determination of friction factor as a function of Reynolds number in pipe flow.
Module 7.	Determination of coefficient of discharge of Venturimeter/ Orifice meter.

Module 8.	Studying laminar-turbulent transition for flow in a tube.
Module 9.	Determination of friction factor as a function of Reynolds number in pipe flow
Module 10.	Flow Visualisation around a body/ over surface
Module 11.	Boundary layer flow over a flat plate