Course Outline and Detailed Syllabus for B. Tech. Mechanical Engineering (3rd Semester)

Semester-III

S. No	Course Code	Course Title	Hours Per Week			Total Contact Hours	Credits
			L	T	P		
1.	MEC201C	Machining Processes	**3**	**0**	**0**	**3**	**3**
2.	MEC202C	Mechanics of Solids	**4**	**0**	**0**	**4**	**4**
3.	MEC203C	Basic Thermodynamics	**3**	**0**	**0**	**3**	**3**
4.	MEC204C	Machine Drawing & Solid Modelling	**1**	**0**	**4**	**5**	**3**
5.	MEC205C	Fluid Mechanics	**4**	**0**	**0**	**4**	**4**
6.	MTH203C	Applied Mathematics for Engineers	**3**	**0**	**0**	**3**	**3**
7.	MEC210C	Mechanics of Solids Lab	**0**	**0**	**2**	**2**	**1**
8.	MEC211C	Machining Processes Lab	**0**	**0**	**2**	**2**	**1**
Total Credits							**22**

MEC201C Machining Processes 3-0-0

Introduction to Manufacturing: Manufacturing needs and Concepts, broad classification of engineering manufacturing processes. Introduction to Machining: Purpose, Principle and Definition. Concept of Generatrix and Directrix, tool- work motion and machine tool drives.

Basics of Metal Cutting: Principles of metal cutting, classification of Metal cutting/machining processes: Orthogonal and oblique cutting, Effect of tool geometry and other cutting parameters, Mechanisms of formation of chips, types of chips formed, chip Breaker.

Forces and Tool Life calculation in Metal Cutting: concept of specific cutting pressure, The forces acting on the cutting tool and their measurement, Merchant's circle diagram, force dynamometer, force and velocity relationship, Tool wear, Factors causing wear, tool life, variables affecting tool life, economical cutting speed, machinability of metals.

General Purpose Machine Tools: lathe, milling, shaping, slotting, planning, drilling, sawing, tapping, reaming, boring, broaching, grinding (cylindrical, surface, and centreless), thread rolling and gear cutting.

Grinding: Basic Principle, Purpose and application grinding. selection of wheels and their conditioning. Super and Micro Finishing Processes: Super finishing, Honing and Lapping. Screw thread and Gear Manufacturing Methods.

Text Books:

1. S. Kalpakjian and S. R. Schmid, Manufacturing engineering and technology, 7th edition of *Pearson publication.*

Reference Books:

1. P. N. Rao, Manufacturing Technology volume-I, 3rd edition of *TMH publication.*
2. R. K. Jain, Production Technology, 17th edition of *Khanna publishers.*

MEC202C Mechanics of Solids 4-0-0

Simple stresses and strains: Concept of stress and strain, general state of stress and strain at a point, strain and displacement field, mechanical properties of solids, the tensile test, one dimensional problems, statically determinate and indeterminate bars, temperature stresses and strains, generalized Hooke's law, transformation of stresses and strains, principal stresses and principal planes, plane stress and plane strain, Mohr's circle.

Stresses in Beams: Types of beams and loadings, shear force and bending moment diagrams, pure bending of symmetric beams, stresses in beams, flexure formula, beams of rectangular, circular, channel, I and T sections, combined direct and bending stresses, shear stress in beams, composite beams.

Deflection of Beams: Symmetric beams, double integration method, singularity functions, moment area method, slope and deflection for statically determinate beams.

Torsion: Torsional equation, solid and hollow circular shafts, solutions of statically determinate and indeterminate shafts subjected to twisting moments, strain energy due to torsion, power transmitted by shafts.

Columns and struts: Strength and stability of columns, end connections, critical loads, Euler's theory, Rankine's Theory, Johnson's parabola, eccentric loading of columns, beam columns.

Text Books:

1. Irving H. S., Introduction to Solid Mechanics, *Prentice Hall India, New Delhi.*
2. Popov E. P., Mechanics of Materials, *Prentice Hall India, New Delhi.*

Reference Books:

1. Ferdinand P. B., Johnston Jr. E. R., DeWolf J. T., Mazurek D. F., Mechanics of Materials, *McGraw Hill Education (India).*
2. Crandall S. H., Dahl N. C., Lardner T. J., Sivakumar M. S., An Introduction to Mechanics of Solids, *McGraw Hill Education (India).*
3. Timoshenko S., Strength of Materials Part 1, Elementary theory and problems, *CBS Publishers.*
4. Timoshenko S., Strength of Materials Part 2, Advanced theory and problems, *CBS Publishers.*

MEC203C Basic Thermodynamics 3-0-0

Introduction: Historical development, microscopic and macroscopic views of matter, thermodynamic systems, properties, processes, cycles, thermal equilibrium and Zeroth law of thermodynamics. The state postulate, pure substance, simple compressible substances and specific heat.

Concept of energy: Mechanical concept of energy, internal energy, conservation of energy, energy transfer as work, various modes, energy transfer as heat, First law for closed system, first law for cyclic processes,. Applications of first law for cycles. Enthalpy, Enthalpy of ideal gases, First law for open systems and 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, coefficient of performance and reversed Carnot cycle. Thermodynamic temperature scale.

Application of second law: Clasius's theorem, entropy concept, principle of increase of entropy and its applications, Second law for closed system, Second law for open system. thermodynamic relations for ideal gases (computation of entropy and internal energy from measurable quantities).Exergy, principle of decrease of exergy, Exergy for open and closed systems and applications.

Heat and work transfer: Calculations involving heat transfer, work transfer and change in thermodynamic properties with various processes, Ideal gas mixture, 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, A/F Ratios, analysis of products of combustion, Orsat apparatus.

Text Books:

1. Cengel Y. A., Thermodynamics: An Engineering Approach, *McGraw Hill Education (India).*

Reference Books:

1. Moran M. J., Shapiro, Fundamentals of Engineering Thermodynamics, *John Wiley & Sons.*
2. Sonntag R. E., Borgnakke C. and Van Wylen G. J., Fundamentals of Thermodynamics, *John Wiley & Sons.*
3. Wark K., Thermodynamics, *McGraw Hill Education (India).*
4. Nag P. K., Engineering Thermodynamics, *McGraw Hill Education (India).*

MEC204C Machine Drawing & Solid Modelling 1-0-4

Introduction to machine drawing: production drawing, assembly drawing. Review of drawing in 3rd angle projection. Orthographic projections of machine blocks, viz. Knuckle joint, Oldham's coupling, Footstep bearing and Tailstock.

Sectional views of machine blocks: (Half, Full) viz. riveted joints, bolted joints and Knuckle joint, Oldham's coupling, Footstep bearing and Tailstock.

Computer Aided Drafting (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 using CAD Software like SolidWorks and Autodesk Inventor.

Solid modelling with CAD: Various sub-components/parts of machine elements, viz. riveted joints, bolted joints and Knuckle joint, Oldham's coupling to be developed on SolidWorks, Autodesk Inventor.

Assembly modelling with CAD: Assembly of machine element components, viz. riveted joints, bolted joints and Knuckle joint, Oldham's coupling using SolidWorks and Autodesk Inventor.

Text Books:

1. Narayana K. L., Kannaiah P., Venkata Reddy K., Machine Drawing, *New Age International.*
2. Sham Tickoo, AutoCAD 2017 for Engineers & Designers, *Dreamtech Press.*
3. Junnarkar N. D., Machine Drawing, *Pearson Education India.*

Other Resources:

1. Engine model resources: http://grabcad.com
2. AUTODESK Inventor Professional 2016 (Free Student Licence).
3. SOLIDWORKS 2017-18 modelling Software.

MTH203C Applied Mathematics for Engineers 3-0-0

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

Complex analysis: 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.

Expansions and Series in calculus: Taylor's & Laurent's expansions, Zeros & poles of analytic functions, Residues. Fourier series, Harmonic analysis.

Fourier transform: Fourier sine and cosine transform. Fourier integral formula and its applications to solution of boundary value problems.

Text Books/Reference Books:

1. Saff E. B., Snider A. D., Fundamentals of Complex Analysis for Mathematics, Science, and Engineering, *Prentice Hall India, New Delhi.*
2. Spiegel, Laplace Transforms, *Schaum Series.*
3. Churchill R. V., Complex variables and applications, *McGraw Hill Education (India).*
4. Snedden N., The use of Integral Transforms, *McGraw Hill Education (India).*

MEC205C Fluid Mechanics 4-0-0

Introduction to Fluid Mechanics: Fluid properties, fluid as continuum, incompressible and compressible fluids, stress at a point, Newton's law of viscosity, Newtonian fluids, concept of pressure, manometers, hydro-static forces on submerged plane and curved surfaces, rigid body motion of fluid.

Fluid kinematics: Eulerian & Lagrangian of fluid motion, velocity & acceleration, stream line, path line and streak line, 2D stream function in Cartesian & polar coordinates, translation, vorticity & angular velocity, circulation, flow classification.

Fluid dynamics: Dimensional analysis, system & control volume, basic & subsidiary laws, transport theorem, laws of conservation of mass, momentum & energy; integral & differential approaches, Euler's and Bernoulli's equations, Bernoulli's equation applications, Navier-Stokes equations, exact solutions.

Boundary layer theory: 2D laminar boundary layer flow, Prandtl B.L. equation, B.L. along a flat plate, Blassius solution, laminar to turbulent transition, concept of turbulent boundary layer theory.

Pipe flow: Laminar & turbulent flows: friction factor, Moody's diagram, energy losses through pipes, bends & pipe fittings, velocity distributions in pipes; power transmission through pipes constriction meter, pilot & pilot-static tubes.

Text Books:

1. White F. M., Fundamentals of Fluid Mechanics, *McGraw Hill Education (India).*

Reference Books:

1. Fox and McDonald, Introduction to Fluid Mechanics, *John Wiley & Sons.*
2. Munson B. R., Fundamental of Fluid Mechanics, *John Wiley & Sons.*

MEC210C **Mechanics of Solids Lab** **0-0-2**

List of Experiments:

1. To perform tensile tests on different specimens and draw stress-strain curves for these materials.
2. To perform compression tests on various specimens.
3. To perform shear tests on different specimens.
4. To perform hardness tests to determine the hardness of different materials: Rockwell, Brinell and Vicker's hardness.
5. To obtain the impact strength of different metals using Charpy and Izod impact tests.
6. To perform torsion tests on different specimens.
7. To determine buckling loads of long columns with different end connections.
8. To perform bending tests on different materials.

MEC211C **Machining Processes Lab** **0-0-2**

List of Experiments:

1. Study of Machine Tools (Lathe, Shaper, Slotter, Planner) – study the types of cutting tools available and relative motions between cutting tool and work piece on each machine tool.
2. Study of Machine Tools (Grinding, Milling, Drilling) – study the types of cutting tools available and relative motions between cutting tool and work piece on each machine tool.
3. Job making on lathe machine.
4. Job making on shaper /slotter machine.
5. Job making on milling machine.
6. Job making on drilling machine.
7. Job making on grinding machine.
8. Study of various types of cutting tools and measurement of tool geometry (Model making of single point/ multi point cutting tools by rubber/ plastic/ wood etc).
9. To Understand the Effect of Chosen Parameters on the type of chip produced.
10. Determination of chip-thickness ratio and shear plane angle during machining.