Mechanical Engineering

Semester III						
S.No	Course Code	Course Name	L	T	P	C
1	EE101T	Introduction to Electrical Systems and Electronics	3	0	0	6
2	ME 203	Fluid Mechanics	3	0	0	6
3	ME205T	Mechanics of Materials	3	0	0	6
4	ME202T	Engineering Materials	3	0	0	6
5	ME212T	ODEs and complex analysis	0	0	3	6
6	ME202C	Machine Drawing and 3D Modelling (New 5 Credit)	0	0	0	5
7	ME201L	Manufacturing processes and Metrology laboratory	3	0	0	3
8	EE101T	Introduction to Electrical Systems and Electronics	3	0	0	6
		Total Credits				39

Mechanical Engineering

1	**Title of the course** (L-T-P-C)	**Introduction to Electrical Systems and Electronics (3-0-1-7)**
2	**Pre-requisite courses(s)**	Exposure to Calculus
3	**Course content**	**From Physics to Electrical Engineering** (a) Lumped matter discipline (b) Batteries, resistors, current sources and basic laws (c) I-V characteristics and modeling physical systems **Basic Circuit Analysis Methods** (a) KCL and KVL, voltage and current dividers (b) Parallel and serial resistive circuits (c) More complicated circuits (d) Dependent sources, and the node method (e) Superposition principle (f) Thevenin and Norton method of solving linear circuits (g) Circuits involving diode. **Analysis of Non-linear Circuits** (a) Toy example of non-linear circuit and its analysis (b) Incremental analysis (c) Introduction to MOSFET Amplifiers (d) Large and small signal analysis of MOSFETs (e) MOSFET as a switch **Introduction to the Digital World** (a) Voltage level and static discipline (b) Boolean logic and combinational gates (c) MOSFET devices and the S Model (d) MOSFET as a switch; revisited (e) The SR model of MOSFETs (f) Non-linearities: A snapshot **Capacitors and Inductors** (a) Behavior of capacitors, inductors and its linearity (b) Basic RC and RLC circuits (c) Modeling MOSFET anomalies using capacitors (d) RLC circuit and its analysis (e) Sinusoidal steady state analysis (f) Introduction to passive filters **Operational Amplifier Abstraction** (a) Introduction to Operational Amplifier (b) Analysis of Operational amplifier circuits (c) Op-Amp as active filters (d) Introduction to active filter design **Transformers and Motors** (a) AC Power circuit analysis (b) Polyphase circuits (c) Introduction to transformers (d) Introduction to motors
4	**Texts/References**	**1**. Anant Agarwal and Jefferey H. Lang, "Foundations of Analog and Digital Electronics Circuits," Morgan Kaufmann publishers, 2005 **2**. Wlilliam H. Hayt, Jr., Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis," Tata McGraw-Hill **3.** Theodore Wildi, "Electrical Machines, Drives and Power Systems," Pearson, 6-th edition. 4. V. Del. Toro, "Electrical Engineering Fundamentals," Pearson publications, 2nd edition.

1	**Title of the course** (L-T-P-C)	**Engineering Materials** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	• Economic, Environmental and Societal Issues in • Materials Science & Engineering • Basic Materials Science: Crystallography, phase diagrams, • grain boundaries, dislocation movements and their effects on • Properties • Material properties: Stress-strain relationships, Tensile • strength, Toughness, Impact Strength, Ductility, Malleability, • Stress intensity, Fatigue • Failure: by Oxidation, Corrosion (Types, impact on material • Strengthening mechanisms: Solute Hardening, chemical hardening, dispersion hardening, Aluminium alloys: Properties, phase diagrams and uses • Copper alloys: Properties phase diagrams and uses • Ferrous Alloys (Steels): Types, properties, iron-carbon • phase diagrams • Material Selection: Ashby Charts • Ceramics: Structure and Properties, Mechanical Properties • of Ceramics, Types and Application of Ceramics, Fabrication • and Processing of Ceramics • Polymers: Molecules, Structures and Shapes, Thermosetting • & Thermoplastic, Polymer Crystals, Polymer Characteristics • and Applications, Synthesis, Processing and Degradation. • Composites: Processing Fiber Reinforced Composites, • Structural Composites, Application of Compositescold working, strain Hardening
4	**Texts/References**	**TEXTBOOKS** **1.** W.D. Callister, Jr. & D.G. Rethwisch: 'Materials science and Engineering: An Introduction', 9th Ed., John Wiley (2014) **2.** W.F.Smith and J.Hashemi: 'Foundations of Materials Science and Engineering', 5th Ed., McGraw-Hill(2009). **REFERENCE** 1. D.R.Askeland, P.P.Phule& W.J. Wright: 'The Science and Engineering of Materials' 7th Ed., Cengage Learning(2014). 2. V.Raghavan: Materials Science and Engineering: A First Course' 6th Ed. PHI(2015). 3. J.F. Shackeford: 'An Introduction to Materials Science for engineers' 8th Ed., Pearson (2016). 4. R.A.Higgins: 'Properties of Engineering Materials' 2nd Ed., Industrial Press (1994). 5. T.Fishcher: 'Materials Science for Engineering Students', Academics Press (2009). 6. V.Raghavan: 'Physical Metallurgy: Principles and Practice' 3rd Ed., PHI (2015)

1	**Title of the course** (L-T-P-C)	**Fluid Mechanics** **(3-0-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	Introduction :Scope, definition of fluid as continuum, fluid properties.(2hr) Fluid Statics: Pressure at a point, basic equation for pressure field, pressure variation(fluid at rest):standard atmosphere, Measurement of pressure manometer,Hydrostatics force on a plane and curve surface, Buoyancy, flotation and stability, pressure variation in a fluid with rigid body motion linear motion, rigid body rotation(4hr) Elementary Fluid Dynamics: Statics, stagnation pressure, Bernoulli Equation assumptions(4hr) Fluid Kinematics The velocity filed : Eulerian and Largrangian flow descriptions, steady and deformation, Acceleration field: material derivative, unsteady and convective effects. Control volume and system representation : Reynolds' Transport Theorem, physical interpretation, steady, unsteady effects, moving control volume, potential function(6Hr) Integral approach Conservation of mass derivation of continuity, fixed, non-deforming control volume, moving non-deforming control volume, deforming control volume. Conservation of momentum: linear momentum and moment of momentum equation and their application., comparison of energy equation with Bernoulli's equation(6hr) Differential approach : linear motion and angular motion with deformation, Conservation of mass: differential form of continuity equation, stream function, Conservation of linear momentum, Inviscid flows, Irrotational flow(6hr) Viscous flow : Stress relationships,NS Equations, Simple solutions for viscous flows(4hr) Dimensional analysis Buckingham's II-theorem,Dimensionless groups & their importance (3hr) Viscous Flow in Pipes : General characteristics of pipe flow, fully developed laminar and turbulent flow, turbulent shear stress, turbulent velocity profile, Pipe Flow rate measurement.(4hr) Boundary layer: Boundary layer characteristics boundary layer structure and thickness on a plate, Blasius boundary layer, momentum integral boundary layer equation for a flat plate(4hr)
4	**Texts/References**	1.Yunus A. Cengel, John M. Cimbala, Fluid Mechanics, Tata McGraw Hill Education,2011 2.F.M.White Fluid Mechanics, Seventh Edition, Tata McGraw Hill Education,2011, 3.Kundu,Pijush K., and Ira M.Cohen.Fluid Mechanic, Elsevier,2001

1	**Title of the course** (L-T-P-C)	**Mechanics of Materials** **(2-1-0-6)**
2	**Pre-requisite courses(s)**	Nil
3	**Course content**	**Module 1:** Basics: Fundamentals of mechanics of deformable solids. Concepts of stress and strain and their relationships. Axially loaded members - Normal stress and strain, Simple (direct) shear stress and strain, Hooke's law, Stresses on inclined planes under axial loading, thermal stresses and strains, statically indeterminate problems. Elastic strain energy under axial loads. **Module 2:** Torsion: torsion of circular cross-section shafts (Solid and hollow sections): Deformation field, Torsion formulae for stresses and angular deflection, Elastic strain energy under torsion, Closely-wound helical springs – stresses and deflections. **Module 3**: Bending: Euler – Bernoulli model: normal and shear stresses, deflections for symmetric bending. Statically indeterminate problems, Elastic strain energy under flexure. **Module 4:** Combined stresses: State of stress and strain at a point , transformation laws , Mohr's circle diagram for stress and principal stresses, thin walled structures : thin cylinders and spheres. Theories of failure: Maximum Normal-Stress theory, Maximum shear-stress theory and Maximum Distortional-energy theory. **Module 5:** Energy methods – Castigliano's theorem and its applications, fictitious-load method. Stability of structures – Buckling of idealized and elastic columns
4	**Texts/References**	**TEXTBOOKS:** 1) S.H Crandall, N.C Dahl and S.J Lardner, An Introduction to Mechanics of Solids, Tata McGraw Hill, Third Edition, 2012. 2) E.P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, 2nd edition, 2012. **REFERENCES:** 1. J. M. Gere and Goodno, Mechanics of Materials, 7th ed, Cengage Learning India, 2012. 2. J.P Den Hartog, Strength of Materials, Dover, 1949. 3. J.M Gere and S.P Timoshenko, Mechanics of Materials, CBS Publishers, 1986 4. R. C. Hibbeler, Mechanics of Materials, Pearson, 10th edition, 2016 . 5. S.P Timoshenko and D.H Young, Elements of strength of Materials, 5th ed, Affiliated East West Press, 1976. 6. F. P. Beer, E. R. Johnston Jr., John T. DeWolf , D. F. Mazurek, Mechanics of Materials, McGraw- Hill Education; 7th edition, 2014 7. M. Salvadori and R. Heller, Structure in Architecture, Prentice Hall Inc, 1963. 8. S.P Timoshenko, History of Strength of Materials, Dover, 1983. 9. M. H. Sadd, Elasticity: Theory, Applications, and Numerics, 1st ed, Elsevier India, 2006.

1	**Title of the course** (L-T-P-C)	**Machine Drawing and 3D Modelling** **(1-0-2-3)**
2	**Pre-requisite courses(s)**	Exposure to Engineering Graphics Lab (ME 111)
3	**Course content**	**Introduction**: Engineering design process and drawings. Drawing standards. Computer aided drafting and use of software packages for engineering drawings **Detachable Fasteners**: Screw threads: conventional representations and specifications; Threaded fasteners: Types, forms, standard, and specifications; Drawing of connections; Foundation bolts; Locking Devices: Classification, principles of operation, standard types and their proportions; Shaft Couplings: Common types, standard proportions for some couplings; Pipe Joints, common pipe connections **Permanent Fastenings**: Rivets: Standard forms and proportions; Riveted Joints: Common types of joints, terminology, proportions and representation; Welds: Types of welds and welded joints, edge preparation, specifications, and representation of welds on drawings **Assembly Drawings**: withsectioning and bill of materials. Assemblies involving machine elements like shafts, couplings, bearing, pulleys, gears, belts, brackets. Engine mechanisms-assembly. Detailed part drawings from assembly drawings **Tool Drawings**: Jigs and fixtures **Production Drawings**: Limits, fits, and tolerances of size and form; Types and grade, use of tolerance tables and specification of tolerances, form and cumulative tolerances, tolerance dimensioning; Surface quality symbols, terminology and representation on drawings, correlation of tolerances and surface quality with manufacturing techniques 3D Modelling exercise: use of Reverse Engineering to disassemble and measure components
4	**Texts/References**	1. K. L Narayana, P. Kannaiah, K. Venkata Reddy. Machine Drawing, 3rd Ed., New age International Publishers, 2006. 2. K.C. Johan. Text Book of Machine Drawing, PHI Learning, 2009.

1	**Title of the course** (L-T-P-C)	**Manufacturing processes and Metrology laboratory (0-0-3-3)**
2	**Pre-requisite courses(s)**	Introduction to Communication Systems
3	**Course content**	List of experiments: Angle measurement using Sine bar Chip Thickness measurement using microscope Calibration of measuring instruments Three Wire Method Of Measuring Pitch Diameter Surface Roughness testing Manual Milling Manual Turning Welding of AI, etc. Shaping Green Sand moulding.
4	**Texts/References**	• Jerzy A. Slade Coordinate Metrology: Accuracy of Systems and Measurements ISSN2195-9862, Springer publisher • Val Marinov Manufacturing Process Design Laboratory Manual, Kendall/Hunt PublishingCompany, ISBN 1465275312, 9781465275318 • R. K. Rajput A Textbook of Manufacturing Technology: Manufacturing Processes • Ghosh and A. K. Mallik, Manufacturing Science, Affiliated East West Press, 1985. HMT,Production Technology, Tata McGraw Hill, 1980. • J. Mcgeough, Advanced Methods of Machining, Chapman and Hall, 1988.

1	**Title of the course** (L-T-P-C)	**ODEs and complex analysis** **3-0-0-6**
2	**Pre-requisite courses(s)**	--
3	**Course content**	• ODEs: Exact equations, integrating factors and Bernoulli equations. Orthogonal trajectories. Lipschitz condition, Picard's theorem, examples on non-uniqueness. Linear differential equations generalities. Linear dependence and Wronskians. Dimensionality of space of solutions, Abel-Liouville formula. Linear ODEs with constant coefficients, the characteristic equations. Cauchy-Euler equations. Method of undetermined coefficients. Method of variation of parameters. Review of power series and series solutions of ODEs. Legendre's equation and Legendre polynomials. Regular and irregular singular points, Extended Power Series Method: Frobenius Method, Bessel's equation and Bessel's functions. Basic Theory of Systems of ODEs, Wronskian, Systems of ODEs as Models in Engineering Applications. • Complex analysis: Definition and properties of analytic functions. Cauchy-Riemann equations, harmonic functions. Power series and their properties. Elementary functions. Cauchy's theorem and its applications. Taylor series and Laurent expansions. Residues and the Cauchy residue formula. Evaluation of improper integrals. Conformal mappings.
4	**Texts/References**	**Textbooks:** **1.** E. Kreyszig, Advanced engineering mathematics (10th Edition), John Wiley (1999). **2.** W. E. Boyce and R. DiPrima, Elementary Differential Equations (8^{th} Edition), John Wiley (2005).