COURSE CURRICULUM

MECHANICAL ENGINEERING- 2019 Batch (III Semester)

Course Code	Course Name	L	T	P	Total Credits
EE 201	Data Analysis	3	0	0	6
HS 201	Economics	3	0	0	6
ME 201	Engineering Mechanics	2	1	0	6
ME 202	Engineering Materials	2	1	0	6
ME 203	Fluid Mechanics	3	0	0	6
ME 205	Machine Drawing and 3D Modelling Laboratory	0	0	3	3
ME 207	Thermodynamics	2	1	0	6
				Total Credits	**39**

2019 Batch (III SEMESTER)

Name of Academic Unit: Electrical Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	EE 201 Data Analysis
ii	**Credit Structure (L-T-P-C)**	(3-0-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	The role of statistics. Graphical and numerical methods for describing and summarising data. Probability. Population distributions. Sampling variability and sampling distributions. Estimation using a single sample. Hypothesis testing a single sample. Comparing two populations or treatments. Simple linear regression and correlation. Case studies.
viii	**Texts/References**	1. Introduction to Probability and Statistics for Engineers and Scientists by Sheldon M. Ross, Elsevier, New Delhi, 3rd edition (Indian), 2014. 2. Probability, Random Variables and Stochastic processes by Papoulis and Pillai, 4th Edition, Tata McGraw Hill, 2002. 3. An Introduction to Probability Theory and Its Applications, Vol. 1, William Feller, 3rd edition, Wiley International, 1968.
ix	**Name(s) of Instructor(s)**	SRMP
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	CSE & ME
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	Analyzing data and interpreting results are integral part of almost every research and it finds extensive use in industry as well. From Machine learning to Finance, its applications are enormous.

Name of Academic Unit: Humanities and Social Sciences
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	HS 201 Economics
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	Basic economic problems. resource constraints and Welfare maximizations. Nature of Economics: Positive and normative economics; Micro and macroeconomics, Basic concepts in economics. The role of the State in economic activity; market and government failures; New Economic Policy in India. Theory of utility and consumer's choice. Theories of demand, supply and market equilibrium. Theories of firm, production and costs. Market structures. Perfect and imperfect competition, oligopoly, monopoly. An overview of macroeconomics, measurement and determination of national income. Consumption, savings, and investments. Commercial and central banking. Relationship between money, output and prices. Inflation - causes, consequences and remedies. International trade, foreign exchange and balance payments, stabilization policies : Monetary, Fiscal and Exchange rate policies.
viii	**Texts/References**	1. P. A. Samuelson & W. D. nordhaus, Economics, McGraw Hill, NY, 1995. 2. A. Koutsoyiannis, Modern Microeconomics, Macmillan, 1975. R. Pindyck and D. L. Rubinfeld, Microeconomics, Macmillan publishing company, NY, 1989. 3. R. J. Gordon, Macroeconomics 4th edition, Little Brown and Co., Boston, 1987. 4. William F. Shughart II, The Organization of Industry, Richard D. Irwin, Illinois, 1990. 5. R.S. Pindyck and D.L. Rubinfeld. Microeconomics (7^{th} Edition), Pearson Prentice Hall, New Jersey, 2009. 6. R. Dornbusch, S. Fischer, and R. Startz. Macroeconomics (9th Edition), McGraw-Hill Inc. New York, 2004.
ix	**Name(s) of Instructor(s)**	--

Name of Academic Unit: Mechanical Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	ME 201 Engineering Mechanics
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	**Module 1:** Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy **Module 2:** Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; **Module 3:** Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines; **Module 4:** Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook; **Module 5:** Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy

		method for equilibrium. Stability of equilibrium. **Module 6:** Particles dynamics- Kinematics of Particles: Rectilinear motion, Plane curvilinear motion - rectangular coordinates, normal and tangential coordinates, polar coordinates, Space curvilinear - cylindrical, spherical (coordinates), Relative and Constrained motion. Kinetics of Particles: Force, mass and acceleration – rectilinear and curvilinear motion, work and energy, impulse and momentum – linear and angular; Impact – Direct and Oblique. Kinetics of System of Particles: Generalized Newton's Second Law, Work-Energy, Impulse-Momentum, Conservation of Energy and Momentum **Module 7:** Introduction to Rigid body dynamics Kinematics of Planar Rigid Bodies: Equations for rotation of a rigid body about a fixed axis, General plane motion, Instantaneous Center of Rotation in Plane Motion Plane Motion of a Particle Relative to a Rotating Frame. Coriolis Acceleration Kinetics of Planar Rigid Bodies: Equations of Motion for a Rigid Body, Angular Momentum of a Rigid Body in Plane Motion, Plane Motion of a Rigid Body and D'Alembert's Principle, Systems of Rigid Bodies, Constrained Plane Motion; Energy and Work of Forces Acting on a Rigid Body, Kinetic Energy of a Rigid Body in Plane Motion, Systems of Rigid Bodies, Conservation of Energy, Plane Motion of a Rigid Body - Impulse and Momentum, Systems of Rigid Bodies, Conservation of Angular Momentum. **Module 8:** Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums
viii	**Texts/References**	**Textbooks:** 1. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 6th Ed, John Wiley, 2008. 2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, 9th Ed, Tata McGraw Hill, 2011. 3. R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2006.

		References: 1. S. P. Timoshenko and D. H. Young, Engineering Mechanics. Fourth Edition. McGraw- Hill, New York, 1956. 2. I. H. Shames, Engineering Mechanics: Statics and dynamics, 4th Ed, PHI, 2002. 3. Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Dynamics – Computational Edition, 1st Ed., Cengage Learning, 2007 4. Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Statics- Computational Edition, 1st Ed., ,Cengage Learning, 2007
ix	**Name(s) of Instructor(s)**	TPG, PS
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental and core course which is essential for appreciating the influence of forces and force systems on particles/rigid bodies for all mechanical engineering students. This basic engineering course forms the base on which other course like Mechanics of Solids and Theory of Machines.

Name of Academic Unit: Mechanical Engineering
Level: UG
Programme: B.Tech.

i	**Title of the course**	ME 202 Engineering Materials
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil
vii	**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 properties), prevention, Passivation, Selective Leaching, Stress Corrosion Cracking, Creep, Embrittlement **Strengthening mechanisms**: Solute Hardening, chemical hardening, dispersion hardening, cold working, strain 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 of Fiber Reinforced Composites, Structural Composites, Application of Composites
viii	**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). REFERENCES 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' 8tn 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)
ix	**Name(s) of Instructor(s)**	
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Nil
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	Course in Engineering materials is required to be comprehensive and advanced as these materials are being used in Mechanical industries.

Name of Academic Unit: Mechanical Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	ME 203 Fluid Mechanics
ii	**Credit Structure (L-T-P-C)**	(3-1-0-8)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	--
vii	**Course Content**	**Introduction:** Scope, definition of fluid, fluid as continuum, fluid properties: density, specific weight, specific gravity, viscosity, kinematic viscosity, classification of fluid motion **Fluid Statics:** Pressure at a point, basic equation for pressure field, pressure variation (fluid at rest): incompressible and compressible fluid, standard atmosphere, Measurement of pressure: manometry, Hydrostatic Force on a plane and curve surface, pressure prism, Buoyancy, flotation and stability, pressure variation in a fluid with rigid body motion – linear motion, rigid body rotation. **Elementary Fluid Dynamics:** Newton's second law along and normal to a streamline, physical interpretation, static, stagnation pressure, Use of Bernoulli Eq.: free jets, confined flows, restrictions on the use of Bernoulli Eq.: compressibility effects, unsteady effects, rotational effects and others. **Fluid Kinematics:** The velocity field: Eulerian and Lagrangian flow descriptions, 1D, 2D and 3D flows, steady and unsteady flows, streamlines, streaklines and pathlines. Acceleration field: material derivative, unsteady and convective effects. Control volume and system representation: Reynolds Transport Theorem, physical interpretation, steady, unsteady effects, moving control volume. **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. First law of thermodynamics: derivation & application of energy Eq., comparison of energy equation with Bernoulli's equation, application of energy equation to non-uniform flows, combination of energy equation and moment of momentum equation.

		Differential approach: linear motion and deformation, angular motion and deformation, Conservation of mass: differential form of continuity equation, stream function, Conservation of linear momentum: description of forces acting on the differential element, equations of motion, Inviscid Flow: Euler's equation of motion, the Bernoulli's equation, Irrotational flow, Bernoulli equation for irrotational flow, the velocity potential, flow net. **Viscous flow**: Stress deformation relationships, Navier-Stokes Eqs., Simple solutions for viscous compressible fluids: parallel flow through straight channel, Couette, plane Poiseuille, Hagen- Poiseuille, flow betn. two co-axial cylinders. **Dimensional analysis and modelling:** Importance of dimensional analysis, Buckingham's Pi Theorem, Dimensionless groups, Dimensional analysis through governing differential equations **Viscous Flow in Pipes:** General characteristics of pipe flow – laminar or turbulent flow, entrance region and fully developed flow, pressure and shear stress. Fully Developed Turbulent Flow – transition from laminar to turbulent flow, turbulent shear stress, turbulent velocity profile. Moody chart, minor losses, non-circular conduits, single pipes and multiple pipe systems, Pipe Flow rate measurement. **Flow Over Immersed Bodies:** Boundary layer characteristics: boundary layer structure and thickness on a flat plate, Blasius boundary layer, momentum integral boundary layer equation for a flat plate, transition from laminar to turbulent, momentum integral boundary layer equation for a flat plate, turbulent boundary layer flow.
viii	**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. Philip J.Pritchard, Alan T.Mcdonald,RobertW.Fox, Introduction to Fluid Mechanics, Wiley, 2009. 4. John F. Douglas, J. M. Gasoriek, Lynne Jack and John Swaffield, Fluid Mechanics, Pearson, 2008.
ix	**Name(s) of Instructor(s)**	DVP, SVP
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental and core course which is essential for appreciating the fluid flow which is of utmost importance for mechanical B.Tech. Major.

Name of Academic Unit: Mechanical Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	ME 205 Machine Drawing and 3D Modelling
ii	**Credit Structure (L-T-P-C)**	(1-0-2-4)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Exposure to Engineering Graphics Laboratory (ME 111)
vii	**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**: with sectioning 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
viii	**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 Mach ne Drawing, PHI Learning, 2009.

		3. V. Lakshminarayanan, M.L. Mathur, Text Book of Machine Drawing (with Computer Graphics)", 12th Ed., Jain Brothers 2007.
ix	**Name(s) of Instructor(s)**	SD
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a core course which is essential for appreciating the machine drawings, especially important for production and assembly purposes.

Name of Academic Unit: Mechanical Engineering
Level: B.Tech.
Programme: B.Tech.

i	**Title of the course**	ME 207 Thermodynamics
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Nil
vii	**Course Content**	Thermodynamic Systems, properties & state, process & cycle **Heat & Work**: Definition of work and its identification, work done at the moving boundary, Zeroth law, **Properties of pure substance**: Phase equilibrium, independent properties, and equations of state, compressibility factor, Tables of thermodynamic properties& theiruse, Mollier Diagram **First law**: First law for control mass & control volume for a cycle as well as for a change of state, internal energy & enthalpy, Specific heats; internal energy, enthalpy & specific heat of ideal gases. SS process, Transient processes. **Second Law of Thermodynamics**: Reversible process; heat engine, heat pump, refrigerator; Kelvin-Planck & Clausius statements ,Carnot cycle for pure substance & ideal gas, Concept of entropy; the Need of entropy definition of entropy; entropy of a pure substance; entropy change of a reversible & irreversible processes; principle of increase of entropy, thermodynamic property relation, corollaries of second law, Second law for control volume; SS & Transient processes; Reversible SSSF process; principle of increase of entropy, Understanding efficiency. **Irreversibility and availability**: Available energy, reversible work & irreversibility for control mass and control volume processes; second law efficiency. **Thermodynamic relations**: Clapeyron equation, Maxwell relations, Thermodynamic relation for enthalpy, internal energy, and entropy, expansively and compressibility factor, equation of state, generalized chart for enthalpy. **Thermodynamic Cycles**: Otto, Diesel, Duel and Joule Third Law of Thermodynamics

viii	**Texts/References**	1. Sonntag R., Claus B. & V. Wylen G, Fundamentals of Thermodynamics, John Wiley, 2000. 2. G Rogers, YR Mayhew, Engineering Thermodynamics Work and Heat Transfer, Pearson 2003 3. J.P Howell, P.O. Bulkins, Fundamentals of Engineering Thermodynamics, McGraw Hill,1987 4. Y Cengal, M A Boles, Thermodynamics: An Engineering Approach, Tata McGraw Hill, 2003. 5. Michael J. & H.N. Shapiro, Fundaments of Engineering Thermodynamics, John Wiley, 2004.
ix	**Name(s) of Instructor(s)**	SSR
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	NA
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	This is a fundamental and core course which is essential for appreciating the thermal and fluid sciences and basics of all fluid and heat transfer.