



SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)

(Affiliated to JNTUK, Kakinada), (Recognized by AICTE, New Delhi)
Accredited by NAAC with 'A' Grade, UG Programmes CE, CSE, ECE, EEE, IT & ME are Accredited by NBA
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

Regulation: R20		II / IV - B.Tech. I - Semester							
MECHANICAL ENGINEERING									
SCHEME OF INSTRUCTION & EXAMINATION (With effect from 2020-21 admitted Batch onwards)									
Course Code	Course Name	Category	Cr	L	T	P	Int. Marks	Ext. Marks	Total Marks
B20 BS 2102	Numerical Methods and Advanced Calculus	BS	3	3	0	0	30	70	100
B20 ME 2101	Engineering Thermodynamics and IC Engines	ES	3	3	0	0	30	70	100
B20 ME 2102	Manufacturing Processes	PC	3	3	0	0	30	70	100
B20 ME 2103	Strength of Materials	PC	3	3	0	0	30	70	100
B20 HS 2101	Managerial Economics and Financial Accountancy	HS	3	3	0	0	30	70	100
B20 ME 2104	Machine Drawing	PC	1.5	0	0	3	30	70	100
B20 ME 2105	Strength of Materials Lab	PC	1.5	0	0	3	15	35	50
B20 ME 2106	Manufacturing Processes Lab	PC	1.5	0	0	3	15	35	50
B20 ME 2107	Modeling using 3D Experience	SOC	2	1	0	2	--	50	50
B20 MC 2102	Professional Ethics and Human Values	MC	0	2	0	0	--	--	--
TOTAL			21.5	18	0	11	210	540	750

Code	Category	L	T	P	C	I.M	E.M	Exam
B20BS2102	BS	3	--	--	3	30	70	3 Hrs.
NUMERICAL METHODS AND ADVANCED CALCULUS								
(Common to ECE & ME)								
Pre-requisites: Basic concepts of calculus.								
Course Objectives: Students are expected to learn								
1	Numerical methods to solve algebraic and transcendental equations. The concept of interpolation and its use for equally and unequally spaced data points.							
2	Methods for numerical evaluation of integrals and for solving first order ODEs.							
3	Concepts of double, triple integrals and its applications.							
4	Concepts of Gradient, divergence, curl and vector integral theorems.							
5	Concept of Analytic function, its implications and simple applications in Electro statics and fluid flow problems.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1.	Find a real root of algebraic and transcendental equations. Fit an interpolation formula and perform interpolation for equally spaced and unequally spaced data.							K3
2.	Evaluate numerically certain definite integrals and solve a first order ordinary differential equation by Euler and RK methods.							K3
3.	Evaluate double integrals and determine the areas.							K3
4.	Evaluate triple integrals and determine the volumes.							K3
5.	Find the gradient of a scalar function, divergence and curl of a vector function. Solve simple problems using vector integral theorems.							K3
6.	Comprehend the concept of Analytic function and apply in Electrostatics and Fluid dynamics							K3
SYLLABUS								
UNIT-I (10Hrs)	Solution of Algebraic and Transcendental Equations: Introduction, Bisection method, Method of false position, Iteration method & Newton-Raphson method. Interpolation: Introduction, forward differences, backward differences and Central differences. Differences of a polynomial, Newton's forward and backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange interpolation formulae.							
UNIT-II (14Hrs)	Numerical Integration and solution of Ordinary Differential equations: Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ rule. Solution of first order ordinary differential equations by Taylor's method, Picard's method, Euler's method, Modified Euler's method, Fourth order Runge-Kutta method.							
UNIT-III (10Hrs)	Multiple integrals: Evaluation of Double integrals, change of order of integration, Change of variables and areas. Evaluation of Triple integrals and volumes.							

UNIT-IV (12Hrs)	Vector calculus: Scalar and vector point functions, Vector Differentiation, Gradient, Directional derivative, Divergence, Curl, Scalar Potential. Line integral, Work done, Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).
UNIT-V (12Hrs)	Functions of a Complex Variable: Definition, limit and continuity of a function of a complex variable, derivative, analytic function, entire function, Cauchy- Riemann equations, Milne-Thomson method, Applications of analytic function to flow problems, and in Electrostatics. Conformal mapping: the transformations defined by $w = z+c$, $w = cz$, $w = 1/z$. The Bilinear transformation.
Text Books:	
1.	Scope and Treatment as in “Higher Engineering Mathematics”, by Dr.B.S.Grewal, 43 rd Edition, Khanna Publishers.
Reference Books:	
1.	Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley
2.	Higher Engineering Mathematics, by B.V.Ramana, Tata McGraw Hill Company.
3.	A text book of Engineering Mathematics, by N.P.Bali and Dr. Manish Goyal, Lakshmi Publications.
4.	Advanced Engineering Mathematics, by H.K.Dass, S.ChandCompany.
5.	Higher Engineering Mathematics, by Dr. M.K.Venkatraman, the NationalPublishingCompany.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2101	ES	3	--	--	3	30	70	3 Hrs.
ENGINEERING THERMODYNAMICS AND IC ENGINES								
(For ME)								
Course Objectives:								
1.	To impart the knowledge of the thermodynamic laws and principles							
2.	To enable the student to prepare an energy audit of any mechanical system that exchange heat and work with the surroundings.							
3.	To Educate the use of working principle of Internal combustion engines (spark ignition and compression ignition) and their performance of Otto, Diesel and Dual cycles.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1.	Apply the concepts of thermodynamic to real life systems and compute the properties of various perfect gases.							K3
2.	Apply the first law of thermodynamics to analyze various thermodynamic systems undergoing different thermodynamic processes.							K4
3.	Examine the second law of thermodynamics of various heat engines and compute their performance & efficiency.							K3
4.	Illustrate the working principles of Internal combustion engines (spark ignition and compression ignition) and compute their performance and efficiency.							K3
SYLLABUS								
UNIT-I (10Hrs)	Introduction: Basic Concepts: System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroth law of thermodynamics, Concept of equality of temperatures- Equation of state- Universal gas constant- Deviations from perfect gas model- Vander wall's equation of state							
UNIT-II (10 Hrs)	First law of thermodynamics: Joule's Experiments-First law of thermodynamics- Isolated systems and steady flow systems- Specific heats at constant volume and pressure- Enthalpy- First law applied to flow systems- Systems undergoing a cycle and change of state- First law applied to steady flow processes-various non-flow processes-Properties of end states- Heat transfer and work transfer- Change in internal energy-throttling and free expansion- Flow processes							
UNIT-III (10 Hrs)	Second law of thermodynamics- Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot's principle, Carnot cycle and its specialties, Clausius theorem, Clausius Inequality, Entropy, Principle of Entropy Increase –Third Law of Thermodynamics.							
UNIT-IV (10 Hrs)	Air standard Cycles- Otto, Diesel, Dual Combustion cycles–Description and representation on P–V& T-S diagram, Thermal Efficiency, Mean Effective Pressure. I.C. engines: classification-comparison of two stroke and four stroke engines- comparison							

	of S.I. & C.I. engines-Valve timing and port timing diagrams- Efficiencies- air standard efficiency, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, volumetric efficiency and relative efficiency-Testing and performances of I.C. engines - Basic principles of carburetion and fuel injection.
UNIT-V (10 Hrs)	Combustion in IC Engines: Normal combustion, abnormal combustion in SI engines, Importance of flame speed and effect of engine variables, pre-ignition, knocking, stages of combustion in CI engines, Delay period and its importance, effect of engine variables, diesel knock, Fuel requirement & ratings, anti-knock additives, types of SI&CI combustion chambers and Design principles.
Textbooks:	
1.	Engineering Thermodynamics, by P.K. Nag, Tata McGraw-Hill Publications Company.
2.	Thermal Engineering by R.K Rajput, Laxmi publications.
3.	Applied Thermodynamics-I by R. Yadav, Central Book House.
4.	A Treatise on Heat Engineering by Vasandhani and Kumar.
5.	Applied Thermodynamics-II by R. Yadav
Reference Books:	
1.	Engineering Thermodynamics by Radhakrishnan, Prentice - Hall India.
2.	An Introduction to Thermodynamics by Y.V.C. Rao, New Age Publications
3.	I.C. Engines by V. Ganesan.
4.	Thermodynamics-An Engineering Approach by Y Cengel & Boles.
5.	I.C. Engines by Mathur and Mehata
e-Resources	
1.	https://nptel.ac.in/courses/127/106/127106135/#
2.	https://nptel.ac.in/courses/112/103/112103262/#

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2102	PC	3	--	--	3	30	70	3 Hrs.
MANUFACTURING PROCESSES								
(For ME)								
Course Objectives:								
1.	To acquaint the student with the basics of manufacturing engineering.							
2.	To acquaint the student to identify the usage of the principles of metal casting, forging, metal forming and welding etc. for manufacturing various mechanical engineering components.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1.	Apply the principles of casting for manufacturing mechanical components.							K3
2.	Distinguish various special casting techniques.							K3
3.	Apply the various metal forming and sheet metal operations for manufacturing mechanical components.							K3
4.	Illustrate various forging techniques.							K3
5.	Distinguish various welding processes.							K3
SYLLABUS								
UNIT-I (10Hrs)	Manufacturing concepts: Product cycle, Job, batch and mass production, Primary and secondary manufacturing processes. Metal Casting Process: Principle of metal casting, Pattern: Materials, Allowances and Types, Core boxes, Moulding sands: ingredients, properties, preparation, types, Moulding tools, Sand moulding, Machine moulding, Melting and pouring Classification of furnaces, Cupola furnace, pouring ladles; Element of gating system, casting defects.							
UNIT-II (08Hrs)	Special Casting Techniques: Permanent mould casting, Pressure die casting, Centrifugal casting, Shell mold casting, Investment casting process.							
UNIT-III (08Hrs)	Metal Forming: Hot & Cold working, Rolling, Extrusion, metal spinning, Drawing, Piercing. Sheet Metal Forming: Concept of spring back, Materials, tools, operations, embossing, coining, stretch forming.							
UNIT-IV (08Hrs)	Forging Processes: Forgability, Forging Materials, Classification: smith, drop, press and machine forging, Forging tools, Forging Operations, High energy rate forming, Swaging.							
UNIT-V (08Hrs)	Welding Processes: Welding basics, Weldability, Classification: Plastic welding (Forge, Resistance), Fusion welding (Gas: Air-acetylene, Oxy-acetylene welding, Oxy-hydrogen, Arc: Shielded Metal Arc Welding, MIG, TIG, Atomic Hydrogen Arc Welding, Sub Merged Arc), Thermit Welding, Solid-state welding (Friction, Ultrasonic, Diffusion and Explosive welding) Soldering and Brazing, Weld defects, Weld inspection and testing. Special Welding Techniques: Electron Beam Welding, Laser Beam Welding, Plasma Arc Welding.							
Text Books:								
1.	Elements of Workshop Technology Vol-1: Manufacturing Processes by S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, MPP, Pvt. Ltd.							

2.	Manufacturing Technology- Foundary, Forming and Welding by P.N. Rao, Tata McGraw- Hill Publishing Company.
Reference Books:	
1.	Process and Materials of Manufacture (4 th Edition) by Roy A. Lindberg, Prentice-Hall of India Private Limited.
2.	Manufacturing Engineering & Technology by Kalpak Jain, Addition Wesley Edition.
3.	Materials and Processes in Manufacturing by De Margo, Black and Kohsen, Prentice Hall of India.
4.	Principles of Metal Casting by Hein and Rosenthol, Tata Mc-Graw Hill India.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2103	PC	3	--	--	3	30	70	3 Hrs.

STRENGTH OF MATERIALS

(For ME)

Course Objectives: Students are expected to

1.	Gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures.
2.	Study engineering properties of materials and stress-strain relationship.
3.	Learn fundamental principles of equilibrium, compatibility, and force-deformation relationship, and principle of superposition in linear solids and structures.
4.	Determine stress, strain, deformation of bars; shear forces, bending moments, slopes and deflections of beams.
5.	Analyze determinate axial structural members: beams, torsional members and shells.

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1.	Understand the concepts of simple stresses and strains under different loads, and apply the knowledge for structural members and calculate principal stresses.	K3
2.	Construct and interpret Shear Force and Bending Moment Diagrams for statically determinate beams.	K3
3.	Calculate the Slope & Deflection for statically determinate beams under different loading conditions.	K3
4.	Determine and sketch the flexural and shear stress distributions of beams subjected to bending.	K3
5.	Examine the stresses produced in circular shafts subjected to twisting moments, and solve for stresses and strains produced in thin and thick-walled cylindrical vessels.	K3

SYLLABUS

UNIT-I (10Hrs)	<p>Simple Stresses: Stress, Strain, Stress-Strain curve, Lateral strain, Poisson's ratio, factor of safety and working stress; Bars of varying cross-section, Compound bars, Complementary Shear stress, Strain energy due to axial loading.</p> <p>Complex Stresses: Stresses acting on an inclined plane under uniaxial, biaxial and general state of plane stress, Principal planes and Principal stresses, Mohr's circle for biaxial stresses.</p>
UNIT-II (10Hrs)	<p>Shear Forces and Bending Moments: Beam - types of loads, types of supports, types of beams, Shear Force and Bending Moment; Relationship between Rate of Loading, Shear Force and Bending Moment; S.F. and B.M. diagrams for cantilever, simply supported and over hanging beams subjected to different loads.</p>
UNIT-III (10Hrs)	<p>Slope and Deflection of Beams: Relation between curvature, slope and deflection; Slope and deflection of cantilever, simply supported and overhanging beams – Double integration method, Macaulay's method and moment area method.</p>

UNIT-IV (10Hrs)	Flexure Stresses in Beams: Theory of pure bending, Flexural formula, section modulus of rectangular, circular, I, and T sections, Determination of bending stress distribution across various beam sections. Shear stresses in Beams: Shear stresses distribution across various beam sections like rectangular, circular, I and T.
UNIT-V (10Hrs)	Torsional Stresses in Shafts: Pure torsion, Torsion formula, analysis of torsional stresses, Power transmitted. Thin and Thick Cylindrical Shells: Stresses and strains in thin cylinders- longitudinal and circumferential stresses and volumetric strain, Stresses and strains in thick cylinders - Lamé's equations- Cylinders subjected to inside and outside pressures, Change in thickness.
Text Books:	
1.	Analysis of Structures by Vazirani and Ratwani - Vol. 1, Khanna Publishers
2.	Introduction to Solid Mechanics by Popov, Pearson Education
Reference Books:	
1.	Strength of Materials by Timoshenko, CBS Publishers.
2.	Strength of Materials by Sadhu Singh, Khanna Publishers.
3.	Strength of Materials by Jindal, Umesh Publications.
e-Resources	
1.	https://mechanicalc.com/reference/strength-of-materials
2.	https://core.ac.uk/download/pdf/47233878.pdf

Code	Category	L	T	P	C	I.M	E.M	Exam
B20HS2101	HS	3	--	--	3	30	70	3 Hrs.
MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTANCY								
(For ME)								
Course Objectives: Students are expected to learn								
1.	To Study Managerial Economics and Demand Analysis							
2.	To familiarize about the Concepts of Cost and Break-Even Analysis.							
3.	To understand the nature of markets and to know the Pricing Policies							
4.	To learn about accounting cycle and preparation of Financial Statements.							
5.	To know the concept of Capital and sources of raising and Depreciation							
Course Outcomes: At the end of the course the student will be able to								
S.No	Outcome							Knowledge Level
1.	Equip oneself with the knowledge of estimating the Demand and demand elasticities for a product.							K2
2.	Have knowledge of Cost and its types and ability to calculate BEP							K3
3.	Understand the nature of different markets							K2
4.	Understand Pricing Practices prevailing in today's business world							K2
5.	Prepare Financial Statements and know how to calculate Profit & Loss for a firm							K3
6.	Know Types of capital and their sources and know how to calculate Depreciation							K2
SYLLABUS								
UNIT-I (10Hrs)	Introduction to Managerial Economics and demand Analysis: Managerial Economics: Definition of Economics & Classification of Economics (Micro & Macro), Meaning, Nature, & Scope of Managerial Economics. Demand Analysis: Concept of Demand, Determinants of Demand, Demand schedule, Demand curve, Law of Demand and its exceptions. Elasticity of Demand, Types of Elasticity of Demand. Importance of demand forecasting and its Methods.							
UNIT-II (10 Hrs)	Cost Analysis: Importance of cost analysis, Types of Cost- Actual cost Vs Opportunity cost, Fixed cost Vs Variable cost, Explicit Vs Implicit cost, Historical cost Vs Replacement cost, Incremental cost Vs Sunk cost; Elements of costs – Material, Labour, Expenses; Methods of costing - Job costing, contract costing, Process costing, Batch costing, Unit costing, Service costing, Multiple costing. Break-even analysis: Determination of Breakeven point - Applications, Assumptions and Limitations of Break -even analysis (Theory only).							
UNIT-III (10 Hrs)	Introduction to Markets & Pricing Policies Market Structures: Salient Features of Perfect Competition, Monopoly, Monopolistic competition, Oligopoly and Duopoly. Pricing: Importance of pricing and its meaning; Methods of Pricing: Cost Based -Full cost, Mark-up, Marginal & Break-even; Demand Based - Penetrating, Skimming; Competition Based- Going rate, Sealed Bid, Discount; Internet Pricing - Flat-rate, Usage sensitive.							
UNIT-IV (8 Hrs)	Introduction to Financial Accounting: Importance of Accounting - Double Entry System of Accounting - Types of Accounts - Journal, Ledger, Trail Balance, Trading Account, Profit and Loss Account and Balance Sheet (outlines only).							

UNIT-V (12 Hrs)	Capital & Depreciation: Types of Capital - Fixed capital & Working Capital, Components of Working Capital, Factors influencing Working capital. Methods of Raising Finance - Short term, medium term and Long term. Depreciation - Meaning, Importance and causes of depreciation; Methods of Depreciation- Straight line and diminishing balancing methods (Theory only)
Text Books:	
1.	A R Aryasri, Managerial Economics and Financial Analysis, TMH Pvt. Ltd, New Delhi
2.	Dr. N.Appa Rao, Dr.P. Vijayakumar: Managerial Economics and Financial Analysis', Cengage Publications, New Delhi
Reference Books:	
1.	Dr.B.Kuberudu& T.V. Ramana : Managerial Economics and Financial anaysis, Himalaya Publishing House
2.	Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
3.	Shashi K. Gupta & R.K. Sharma Management Accounting, Kalyani Publishers
4.	Maheswari S.N, An Introduction to Accountancy, Vikas Publishing House Pvt Ltd

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2104	PC	--	--	3	1.5	30	70	3 Hrs.
MACHINE DRAWING								
(For ME)								
Course Objectives:								
1.	To expose the students to sketch various fastenings (Temporary and permanent), Joints, couplings, key and to familiarize with dimensional and geometrical tolerances symbols for a drawing.							
2.	To provide an understanding and draw assembly and drawing of various engine components and machine tool components to the students.							
3.								
Course Outcomes								
S.No	Outcome							Knowledge Level
1.	Apply standard empirical formulae for various screw threads and fastenings							K3
2.	Illustrate various keys and riveted joints							K3
3.	Identify various joints and couplings							K3
4.	Discover the type of fit and to provide dimensional, and geometrical tolerances							K3
5.	Prepare Assembly drawings for various engine and machine tool components.							K3
SYLLABUS								
8Hrs	Screw threads & Fastenings: Screw threads -Unified, Whitworth, British association, square, acme, knuckle. Screw Fastenings -Square nut, flanged nut, hexagonal headed bolt, square headed bolt, stud bolt, lock nut.							
8Hrs	Rivet-heads, Riveted joints & Keys: Rivet-heads – Snap or cup, Pan, Conical, Countersunk, Rounded countersunk, Ellipsoid Riveted joints – single riveted lap joint, double riveted (zigzag) lap joint, single riveted butt joint (single & double strap). Keys - Sunk taper key, saddle key, Round key, key with gib head, woodruff key.							
12Hrs	Joints and Couplings: Joints - socket and spigot joint, Cotter-joint with sleeve. Couplings : Flanged, Universal and Oldham coupling.							
8Hrs	Fits, Indication of geometrical tolerances: Fits - Clearance, Transition and Interference, identify the type of fit. Indication of geometrical tolerances – Straightness, Flatness, Roundness, Cylindricity, Parallelism, Squareness, Angularity, Concentricity, Symmetry.							
12Hrs	Assembly drawings: Simple eccentric, swivel bearing, plumber block, Screw Jack and Stuffing Box.							
Text Books:								
1.	Machine Drawing, by N.D.Bhatt, Charotal Publishing House.							
2.	Machine Drawing by K.L Narayan, P. Kannaiah and K. Venkata Reddy, New Age.pUBLIATIONS							

Reference Books:	
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1.	Engineering Drawing, by A.C.Parkinson, Wheeler Publishing.
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2.	Production Drawing by K.L Narayan, P. Kannaiah and K. Venkata Reddy, New Age.
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Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2105	PC	-	--	3	1.5	15	35	3 Hrs.
STRENGTH OF MATERIALS LAB								
(For ME)								
Course Objectives:								
1	Ability to identify different types of loads and measure them.							
2	Ability to measure material properties of different materials using different methods.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1	Analyze the relationship between load and deformation of different materials under the influence of axial (tensile & compressive), shear and bending loads.							K4
2	Analyze the torsional stresses produced in different machine members, e.g., shafts and springs, and to compute the rigidity modulus of their materials.							K3
3	Examine the strength of different materials under impact loads.							K3
4	Determine the indentation hardness of different materials on different hardness scales.							K3
SYLLABUS								
1	Tensile test on mild steel specimen							
2	Compression test on wooden specimen							
3	Single and double shear tests on mild steel specimen							
4	Torsion Test on solid circular shaft.							
5	Izod impact test on given material							
6	Charpy impact test on given material							
7	Brinell hardness test on given material							
8	Rockwell hardness test on given material							
9	Vickers hardness test on given material							
10	Compression and tension tests on helical springs							
Reference Books:								
1	Strength of Materials, by Timoshenko							
2	Strength of Materials -By Jindal, Umesh Publications							
3	Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman.							

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2106	PC	--	--	3	1.5	15	35	3 Hrs.
MANUFACTURING PROCESSES LAB								
(For ME)								
Course Objectives:								
1.	To impart hands-on practical exposure on manufacturing processes and equipment.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1	Apply the knowledge of casting, welding and forging to make various sand moulds, welded joints and forged components.							K3
2	Distinguish various moulding sand tests.							K3
SYLLABUS								
1.	Prepare a sand mould of stepped pulley.							
2.	Prepare a sand mould of bend pipe							
3.	Inspect the grain fineness number of silica sand.							
4.	Examine the moisture and clay content in the given moulding sand.							
5.	Analyze the compression strength of moulding sand specimen.							
6.	Analyze the shear strength of moulding sand specimen.							
7.	Analyze the hardness of moulding sand specimen.							
8.	Prepare a ventrod using forging operations.							
9.	Prepare a S-hook using forging operations.							
10.	Prepare a lap joint by arc welding process							
11.	Prepare a butt joint by arc welding process							
12.	Prepare a T-joint by arc welding process							
Reference Books:								
1.	Elements of Workshop Technology Vol-1 Manufacturing Processes by S.K.Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, MPP, Pvt. Ltd.							
2.	Manufacturing Technology- Foundry, Forming and Welding by P.N.Rao, Tata McGraw Hill Publishing Company.							

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2107	SC	1	--	2	2	--	50	3 Hrs.
MODELING USING 3D EXPERIENCE								
(Skill Oriented Course)								
CourseObjective:								
1.	To develop skill to use software to create 2D and 3D models.							
CourseOutcomes: At the end of the course students								
S.No	Outcome							Knowledge Level
1	Can use interface of 3D Experience							K3
2	Can use command panel, menus, viewports and command icons							K3
3	Can create two dimensional drawings in CATIA							K4
4.	Can create 3D part drawingsusing commands in CATIA							K4
SYLLABUS								
Session 1	Workbench Introduction Types of sketches Creating Profiles Practice of profile tool bar with 3 to 4 basic sketches							
Session 2	Sketcher constraints Sketcher operations Practice 5 sketches with different constraints							
Session 3	Transformation of profiles Projection from 3D elements Practice of transform tools with suitable sketches Sketch analysis Sketch modifications Create 5 to 10 sketches with ISO constraint							
Session 4	Part Design workbench introduction Reference elements Practice of types of point, line and planes Basic solid features Practice of basic 2D to 3D Parts Advanced solid features Practice of Ribs Slots and multi sections							
Session 5	Dress up features Practice of fillets, chamfers and shells Advanced dress up features Practice of draft and other features							
Session 6	Transformation of solids Practice of pattern, mirror and scaling Surface based features Practice of splitting solids with surfaces Maintenance of specifications tool							
Session 7	Introduction to body concept Explain the needs of body concepts Boolean operations Practice 3D models using Booleans							

Session 8	Creation of complex parts using body concepts Practice 3 to 5 complex solids using body concepts
Session 9	Editing Solid geometry Editing & replacing of bodies and sketches
Session 10	Drafting introduction to workbench Drafting approach, view creation, dimensioning, geometric modification Editing option
ReferenceBooks:	
1.	Engineering Drawing, by N.D.Bhatt, Charotal Publishing House.
2.	Machine Drawing, by N.D.Bhatt, Charotal Publishing House.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20MC2102	MC	2	--	--	--	--	--	--
PROFESSIONAL ETHICS AND HUMAN VALUES								
Common to AIDS,CSBS,CE,EEE & ME								
Course Objectives:								
1.	To create an awareness on Engineering Ethics and Human Values.							
2.	To instill Moral and Social Values and Loyalty.							
3.	To appreciate the rights of others.							
4.	To create awareness on assessment of safety and risk.							
Course Outcomes								
S.No	Outcome							Knowledge Level
1.	Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field. Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships and field work.							K2
2.	Identify the multiple ethical interests at stake in a real-world situation or practice and Articulate what makes a particular course of action ethically defensible							K2
3.	Assess their own ethical values and the social context of problems							K3
4.	Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects.							K3
5.	Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.							K4
SYLLABUS								
UNIT-I (8 Hrs)	Human Values: Morals, Values and Ethics-Integrity-Work Ethic-Service learning Civic Virtue Respect for others Living Peacefully Caring Sharing Honesty -Courage-Cooperation Commitment Empathy Self Confidence Character Spirituality.							
UNIT-II (8 Hrs)	Engineering Ethics: Senses of 'Engineering Ethics-Variety of moral issued- Types of inquiry Moral dilemmas Moral autonomy- Kohlberg's theory-Gilligan's Theory -Consensus and controversy Models of professional roles-Theories about right action-Self-interest - Customs and religion Uses of Ethical theories Valuing time Cooperation Commitment.							
UNIT-III (8 Hrs)	Engineering as Social Experimentation: Engineering As Social Experimentation- Framing the problem- Determining the facts codes of Ethics- Clarifying Concepts- Application issues Common Ground -General Principles- Utilitarian thinking respect for persons.							
UNIT-IV (8 Hrs)	Engineers Responsibility for Safety and Risk: Safety and risk Assessment of safety and risk. Risk benefit analysis and reducing risk Safety and the Engineer-Designing for the safety- Intellectual Property rights(IPR)							
UNIT-V (8 Hrs)	Global Issues: Globalization- Cross-culture issues-Environmental Ethics- Computer Ethics Computers as the instrument of Unethical behavior Computers as the object of Unethical acts Autonomous Computers-Computer codes of Ethics- Weapons Development -Ethics and Research Analyzing Ethical Problems in research.							

Reference Books:	
1.	"Engineering Ethics includes Human Values" by M.Govindarajan, S.Natarajan- and, V.S.Senthil Kumar-PHI Learning Pvt Ltd-2009.
2.	"Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
3.	"Ethics in Engineering" by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill-2003.
4.	"Professional Ethics and Morals" by Prof.A.R.Aryasri, DhanikotaSuyodhana-Maruthi Publications.
5.	"Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.JayakumaranLaxmi Publications
6.	"Professional Ethics and Human Values" by Prof.D.R.Kiran
7.	"Indian Culture, Values and Professional Ethics" by PSR Murthy- BS Publication.
8.	. Professional Ethics by R. Subramaniam - Oxford publications, New Delhi.

Regulation: R20		II / IV - B.Tech. II - Semester							
MECHANICAL ENGINEERING									
SCHEME OF INSTRUCTION & EXAMINATION (With effect from 2020-21 admitted Batch onwards)									
Course Code	Course Name	Category	Cr	L	T	P	Int. Marks	Ext. Marks	Total Marks
B20BS 2203	Operations Research	BS	3	3	0	0	30	70	100
B20ME 2201	Fluid Mechanics and Hydraulic Machines	PC	3	3	0	0	30	70	100
B20 ME 2202	Applied Thermodynamics	PC	3	3	0	0	30	70	100
B20ME 2203	Metal Cutting and Machine Tools	PC	3	3	0	0	30	70	100
B20ME 2204	Kinematics of Machinery	PC	3	3	0	0	30	70	100
B20ME 2205	Fluid Mechanics and Hydraulic Machines Lab	PC	1.5	0	0	3	15	35	50
B20ME 2206	Machine Tools Lab	PC	1.5	0	0	3	15	35	50
B20ME 2207	Mechanical Engineering Lab	PC	1.5	0	0	3	15	35	50
B20ME 2208	Advanced Surface and Assembly Modeling using CATIA	SOC	2	1	0	2	--	50	50
B20 MC 2201	English Proficiency	MC	0	2	0	0	--	--	--
TOTAL			21.5	18	0	11	195	505	700

Code	Category	L	T	P	C	I.M	E.M	Exam
B20BS2203	BS	3	--	--	3	30	70	3 Hrs.
OPERATIONS RESEARCH								
(For ME)								
Course Objectives:								
1.	To acquaint the students with basic Operation Research concepts, Formulation of LPP and its solution using various methods.							
2.	To build capabilities in the students to analyze the various transportation and assignment problems, job sequencing problems, inventory problems, Games theory and Queuing Models.							
3.	To familiarize the students with project management techniques i.e., PERT and CPM .							
Course Outcomes: Upon successful completion of the course, the students will be able to								
S.No	Outcome							Knowledge Level
1.	Describe the basic Operations Research models, formulate and solve Linear Programming problems for industrial and business applications							K4
2.	Build and Solve Transportation and Assignment problems using appropriate methods for different situations.							K4
3.	Determine the optimal solutions for various Job Sequencing and Inventory models for industrial applications.							K4
4.	Analyse and solve various Games theory and Queuing Models in real situations							K4
5.	Design and schedule various project management problems by CPM & PERT.							K4
SYLLABUS								
UNIT-I (10Hrs)	Introduction to OR: Definition of OR, Characteristics and phases of OR, Scope of OR, OR models, General methods for solving OR models, Roll of computers in OR. Linear Programming: Formulation, Graphical Solution, Simplex Method,Artificial Variable Technique-Big-M method, Duality.							
UNIT-II (10 Hrs)	Transportation Model: Balanced and Unbalanced transportation problems-Initial solution by North West Corner Rule, Lowest Cost Method and VAM, Optimality test by MODI method, Degeneracy in TP. Assignment Model: Hungarian algorithm, Balanced and Unbalanced Assignment Problems, Travelling Salesman Problems.							
UNIT-III (10 Hrs)	Job Sequencing: Introduction, Assumptions, Johnson's algorithm forN-Jobs 2-Machines Problems, N-Jobs 3-Machines Problems, N-Jobs M-Machines Problems, Graphical solution for 2-Jobs and M-Machines Problems. Inventory Models: Definition ofInventory, Costs associated with Inventory Problems, Classification of Models, EOQ Model with and without Shortages,Inventory Problems with Price Breakups.							
UNIT-IV (10 Hrs)	Game Theory: Introduction, Basic definitions, Two Person Zero Sum Games, Minimax criterion, Saddle point, Value of game, Solution of games with saddle point, Mixed Strategy Games-Arithmetic method, Dominance principle to reduce size of game, Graphical Method, Algebraic solution to rectangular games. Queuing Theory: Structure of Queuing Models, Characteristics of Queuing process, Kendall's notation, Single channel systems-(M/M/1:∞/FIFO) model and (M/M/1:N/FIFO) model.							

UNIT-V (10 Hrs)	Network Analysis: Introduction, Project scheduling by CPM and PERT, Network diagram representations, Rules to construct Network diagrams, Time estimates in network analysis- EST, EFT, LST, LFT, float/slack and critical path, Time estimates and Probability considerations in PERT, Crashing in PERT
Text Books:	
1.	Operations Research by S.D Sharma.
2.	Operations Research by V. K. Kapoor.
Reference Books:	
1.	Operations Research - KantiSwaroop, P.K. Gupta, Man Mohan, SulthanChand&Sons Education.
2.	Operations Research - Hamdy A Taha – Pearson Education.
3.	Operations Research -PanneerSelvan Prentice Hall of India.
4.	Introduction to Operations Research, F.S. Hiller, G.J. Liberman, TMH.
Web links	
1.	https://nptel.ac.in/courses/112/106/112106134/
2.	https://nptel.ac.in/courses/110/106/110106062/

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2201	PC	3	--	--	3	30	70	3 Hrs.
FLUID MECHANICS AND HYDRAULIC MACHINES								
(For ME)								
Course Objectives:								
1.	Understanding the properties of fluids and principles of buoyancy.							
2.	To obtain knowledge on types of fluid flow and applications of continuity and Bernoulli's equations.							
3.	Knowledge on fluid flowing through pipe and boundary layer principles.							
4.	To obtain the knowledge to draw velocity triangles and on hydraulic turbines							
5.	Understanding and analyzing centrifugal and reciprocating pumps							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1.	Understand the basic concepts and properties of fluids.							K2
2.	Apply the principles of fluid kinematics and dynamics in solving problems.							K3
3.	Analyze and solve fluid flow problems in pipe and understanding boundary layer theory.							K4
4.	Analyze and evaluate the performance of hydraulic turbines.							K4
5.	Analyze and evaluate the performance of hydraulic pumps.							K4
SYLLABUS								
UNIT-I (10Hrs)	Fluid Statics: Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Newton law of viscosity. Pressure at a point, Measurement of pressure- Piezometer, U-tube and differential tube manometers, Buoyancy and floating, Meta-centre.							
UNIT-II (10 Hrs)	Fluid Kinematics: Introduction, methods of describing the fluid motion, Classification of flows, velocity and acceleration equations, Stream line, path line and streak lines and stream tube, continuity equation, Stream function, velocity potential function, introduction to free and forced vortex flows. Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equation, Measurement of flow through Venturimeter, Orifice meter and Pitot tube.							
UNIT-III (10 Hrs)	Flow Through Pipes: Reynolds experiment - Darcy Weisbach equation - Minor losses in pipes - pipes in series and pipes in parallel -total energy line-hydraulic gradient line. Boundary Layer Theory: Development of boundary layer along a thin flat plate, laminar boundary layer and turbulent boundary layer, Laminar sub layer, boundary layer separation and its control.							
UNIT-IV (10 Hrs)	Impact of Jets: Hydrodynamic force of jets on stationary and moving vanes, velocity diagrams, work done and efficiency. Flat, inclined and curved vanes - jet striking centrally and at tip, flow over radial vanes. Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton							

	wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, draft tube theory, functions and efficiency. Performance of hydraulic turbines, geometric similarity, specific speed, unit quantities, characteristic curves.
UNIT-V (10 Hrs)	<p>Hydraulic Pumps</p> <p>Centrifugal pumps: classification, working, work done, monomeric head, losses and efficiency, Minimum starting speed, specific speed – pumps in series and parallel – performance characteristic curves, cavitation.</p> <p>Reciprocating Pumps: Types, working principle, Power required by a Reciprocating pump, Coefficient of discharge, Slip and negative slip, Effect of acceleration of piston on velocity and pressure in suction and delivery pipes, Indicator diagram, Definition and purpose of air vessels.</p>
Text Books:	
1.	Fluid Mechanics & Hydraulic Machines - R.K.Bansal, Laxmi Publications, 2009.
2.	Hydraulics and Fluid Mechanics - P.N. Modi, S.M. Seth 2nd edition, Standard Book House, 2005.
3.	Hydraulic Machines - Jagadish Lal, MPP, 1994.
Reference Books:	
1.	Fluid Mechanics & Fluid Power Engineering – D.S. Kumar, Second Edition, SK. Kataria & Sons Publishers, 2014.
2.	Fluid Mechanics & Hydraulic Machines – R.K.Rajput, Fourth Edition, S.Chand & Company, 2008.
3.	Fluid Mechanics: F. M. White.
e-Resources	
1.	Prof. S.K. Som, IIT Kharagpur, Fluid Mechanics & Hydraulic Machines. Web: http://nptel.ac.in/courses/112105171/
2.	Prof. Gowtham Biswas, IIT Kharagpur, Fluid Mechanics & Hydraulic Machines. Web: http://nptel.ac.in/courses/112104118/
3.	http://www.efluids.com/
4.	http://fluid.power.net/
5.	www.pumps.org/

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2202	PC	3	--	--	3	30	70	3 Hrs.
APPLIED THERMODYNAMICS								
(For ME)								
Course Objectives:								
1.	To expose the basic principles of steam properties and industrial application of steam							
2.	To study the thermodynamic analysis of Rankine cycle and its modifications.							
3.	To analyze the energy transfers and transformations in these components including individual performance evaluation							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1.	Illustrate the laws of thermodynamics for estimating the properties of pure substance.							K3
2.	Analyze the working of vapour power cycles and evaluate the performance of modified Rankine cycles.							K4
3.	Outline the functionality of steam nozzle, steam and gas Turbines in power plants to estimate their performance.							K4
4.	Use the laws of thermodynamics for estimating the performance of steam condensers and steam boilers in power plants							K3
SYLLABUS								
UNIT-I (10Hrs)	Properties of Pure Substance: Definition of pure substance, phase change of a pure substance, p-T (Pressure-Temperature) diagram for a pure substance, p-V-T(Pressure-Volume-Temperature) surface, phase change terminology and definitions, property Diagrams in common use, Formation of steam, Important terms relating to steam formation, Thermodynamic properties of steam and steam tables, External work done during evaporation, Internal latent heat, Internal energy of steam, Entropy of water, Entropy of evaporation, Entropy of wet steam, Entropy of superheated steam, Enthalpy-Entropy (h-s) charts for Mollier's diagram, Determination of dryness fraction-Tank or bucket calorimeter, throttling calorimeter, separating and throttling calorimeter							
UNIT-II (10 Hrs)	Vapor Power Cycles: Vapor power cycle- Rankine cycle- Reheat cycle(single Reheater)- Regenerative cycle- Thermodynamic variables effecting efficiency and output of Rankine and Regenerative cycles(Single open feed water heater)- Improvements of efficiency, Binary vapor power cycle							
UNIT-III (10 Hrs)	Steam Nozzles: Type of nozzles-Flow through nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles- - Steam injectors. Steam Turbines: Classification of steam turbines- Impulse turbine and reaction turbine- Compounding in turbines- Velocity diagrams in impulse and reaction turbines- Degree of reaction- Condition for maximum efficiency of reaction turbines							
UNIT-IV (10 Hrs)	Steam Boilers: Working principle of various boilers their accessories and mountings (Simple vertical, Cochran, Babcock & Wilcox and Lancashire Boiler), Performance of boilers (simple problems)							

	Steam Condensers: Classification of condenser- Jet, Evaporative and surface condensers- Vacuum and its measurement- Vacuum efficiency- Sources of air leakage in condensers- Condenser efficiency- Daltons law of partial pressures- Determination of mass of cooling water- Air pumps.
UNIT-V (10 Hrs)	Gas Turbines: Simple gas turbine plant- Ideal cycle, closed cycle and open cycle for gas turbines Efficiency, work ratio and optimum pressure ratio for simple gas turbine cycle- Parameters of performance- Actual cycle, regeneration, Inter-cooling, and reheating, closed and semi-closed cycle, Jet propulsion and Rockets
Text Books:	
1.	Thermodynamics and Heat Engines/R.Yadav, Volume -II /Central Publishing House.
2.	Heat Engineering /V.PVasandani and D.S Kumar/Metropolitan Book Company, New Delhi.
3.	Thermal Engineering, by R. K. Rajput,Lakshmi Publications.
4.	A Treatise on Heat Engineering by Vasandhani and Kumar.
5.	Engineering Thermodynamics, PK Nag 6th Edn , McGraw Hill
Reference Books:	
1.	Thermal Science and Engineering by D.S. Kumar, S.K. Kataria and Sons.
2.	Thermal Engineering – R.S. Khurmi& J.S. Gupta- S. chand Pub.
3.	Thermal Engineering / PL Ballaney, Khanna Publishers
4.	Thermal Engineering-M.L. Marthur& Mehta/Jain bros. Publishers.
5.	Gas Turbines, by Cohen and Rogers.
e-Resources	
1.	https://nptel.ac.in/courses/112/103/112103275/#
2.	https://nptel.ac.in/courses/112/103/112103275/#

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2203	PC	3	--	--	3	30	70	3 Hrs.
METAL CUTTING AND MACHINE TOOLS								
(For ME)								
Course Objectives:								
1.	To give a clear understanding of the mechanism of machining to the students.							
2.	To describe the mechanisms of the various machine tools, types of machine tools, various operations that can be performed on them, machining time and force calculations etc. to the students.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1.	Analyze mechanics of metal cutting to determine cutting forces, tool life, tool wear.							K3
2.	Differentiate various machining operations on lathe, shaper, planer, slotting and boring machine tool							K3
3.	Illustrate various machining operations on milling, drilling and broaching machines.							K3
4.	Describe various grinding and micro finishing operations.							K3
5.	Distinguish various Unconventional methods of machining process such as AJM,USM,EDM,ECM.							K3
SYLLABUS								
UNIT-I (08Hrs.)	Mechanics of Metal Cutting: Orthogonal and oblique cutting, mechanics of chip formation, types of chips; classification, nomenclature, signature (ASA & ISO systems) of single point cutting tools, tool materials; tool wear and tool life; Cutting Forces-Merchant's circle, Machinability, Cutting fluids.							
UNIT-II (12Hrs.)	Machine tools using Single point cutting tools: Engine lathe; Capstan and turret lathe, shaper, planner, Slotter and boring-Types, Parts, Specifications, Mechanisms, Operations and machining parameters.							
UNIT-III (12 Hrs.)	Machine tools using Multi point cutting tools: Drilling machine- Types, Parts, Specifications, Mechanisms, Types of drills, Operations and machining parameters Milling machine- Types, Parts, Specifications, Mechanisms, Attachments, Types of Milling cutters, Operations, machining parameters, Indexing methods. Broaching machine- Types, Parts, Specifications, Types of Broaches, Nomenclature of pull broach, Operations and machining parameters							
UNIT-IV (08 Hrs.)	Machine tools using Abrasive wheels: Grinding Machine- Types, Parts, Specifications, Manufacturing of grinding wheel-bonding processes, grit, grade and structure, selection of grinding wheels, mounting of grinding wheels, glazing, loading, dressing and truing of grinding wheel, Operations and machining parameters. Micro finishing Operations-Lapping, honing, super finishing, polishing and buffing.							
UNIT-V (08 Hrs.)	Unconventional Methods of Machining: Process, Characteristics, Advantages, Limitations, Applications of Abrasive Jet Machining (AJM), Ultrasonic Machining (USM),							

	Water Jet Machining (WJM), Electro Discharge Machining (EDM), Wire-cut EDM, Electron Beam Machining (EBM), Plasma Arc Machining (PAM), Laser Beam Machining (LBM), Electro Chemical Machining (ECM), Electro Chemical Grinding (ECG).
Text Books:	
1.	Elements of Workshop Technology Vol-2: Machine Tools by S.K. Hajra Choudhury, A.K. HajraChoudhury, Nirjhar Roy, MPP, Pvt. Ltd.
2.	Metal Cutting Principles by M.C. Shaw, MIT Press, Cambridge.
3.	Process and Materials of Manufacture (4th Edition) by Roy A. Lindberg, Prentice-Hall of India Private Limited.
Reference Books:	
1.	Fundamentals of Metal Machining and Machine Tools by Geoffrey Boothroyd, International Student Edition, McGraw-Hill Book Company.
2.	Metal Cutting Principles by M.C. Shaw, MIT Press, Cambridge.
3.	Advanced Methods of Machining by J. A. McGeough, Chapman & Hall Publishers.
4.	Metal Cutting-Theory and Practice by Amitabha Bhattacharya, Central Book Publishers.
5.	Production Engineering by P.C. Sharma, S. Chand and Company.

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2204	PC	3	--	--	3	30	70	3 Hrs.
KINEMATICS OF MACHINERY								
(For ME)								
Course Objectives:								
1.	To Impart the knowledge about various plane mechanisms and its inversions							
2.	To provide foundation for relative motion, velocity and accelerations of the various elements in a mechanism.							
3.	To understand the concept of various straight line motion mechanisms and basic steering gears							
4.	To facilitate students to understand the functions of cams, gears and gear trains							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1.	Examine the plane motion mechanism with single degree of freedom							K2
2.	Illustrate the importance of relative motion, velocity, and accelerations of the various elements in a plane mechanism							K3
3.	Analyze various plane mechanisms like straight line motion mechanisms and Automobile steering gear mechanisms							K4
4.	Understand the importance of various power transmission systems and analyze motion of higher pairs like toothed gears, gear trains and cams							K4
SYLLABUS								
UNIT-I (10 Hrs)	<p>Mechanisms: Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematics pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully and incompletely constrained .</p> <p>Mechanism and Machines – Mobility of Mechanisms : Degree of freedom, Grubler's criterion, classification of machines – kinematics chain – inversions of mechanism – inversions of four bar chain, single and double slider crank chains, Mechanical Advantage and Transmission angle</p>							
UNIT-II (10 Hrs)	<p>Kinematics: Velocity and acceleration – Motion of a link – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method.</p> <p>Plane motion of body: Instantaneous center of rotation– Three centers in line theorem – Graphical determination of instantaneous center, determination of angular velocity of links by instantaneous center method.</p> <p>Analysis of Mechanisms: Analysis of slider crank chain for displacement- velocity and acceleration of slider – Acceleration diagram for a given mechanism. Coriolis acceleration - determination of Coriolis component of acceleration</p>							
UNIT-III (10 Hrs)	<p>Straight-line motion mechanisms: Exact and approximate copied and generated types – Peaucellier - Hart - Scott Russel- Modified Scott Russel – Grasshopper – Watt - Tchebicheff's - Pantographs</p> <p>Steering gears: Conditions for correct steering – Davis Steering gear, Ackerman's steering gear.</p> <p>Hooke's Joint: Single and double Hooke's joint –velocity ratio – application – Problems</p>							

UNIT-IV (10 Hrs)	Cams: Definitions of cam and followers – their uses – Types of followers and cams – Terminology – Types of follower motion - Uniform velocity, Simple harmonic motion and uniform acceleration and retardation. Construction of cam profiles- Cam with knife edged follower and roller follower Maximum velocity and maximum acceleration during outward and return strokes.
UNIT-V (10 Hrs)	Higher pair: Friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion – involutes profiles – phenomena of interferences – Methods of interference. Condition for minimum number of teeth to avoid interference – expressions for arc of contact and path of contact of Pinion & Gear Gear Trains: Introduction – Types – Simple – compound and reverted gear trains – Epicyclic gear train. Methods of finding train value or velocity ratio of Epicyclic gear trains. Torques in epicyclic gear trains
Text Books:	
1.	Theory of Machines / S.S Ratan/ Mc. Graw Hill Publ
2.	Theory of machines / Khurmi / S.Chand.
3.	Mechanism and machine theory by Ashok G. Ambedkar, PHI Publications
Reference Books:	
1.	Mechanism and Machine Theory / JS Rao and RV Dukkupati / New Age.
2.	Theory of Machines / Shiegly / MGH
3.	Theory of Machines / Thomas Bevan / CBS Publishers

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2205	PC	--	--	3	1.5	15	35	3 Hrs.

FLUID MECHANICS AND MACHINERY LAB

(For ME)

Course Objectives:

1.	This course will provide a basic understanding of flow measurements using various types of flow measuring devices, calibration and losses associated with these devices
2.	Energy conversion principles, analysis and understanding of hydraulic turbines and pumps will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves

Course Outcomes: At the end of the course students will be able to

S.No	Outcome	Knowledge Level
1	Perform Experiments to determine the coefficient of discharge of flow measuring devices	K3
2	Conduct experiments on hydraulic turbines and pumps to draw characteristic curves	K3
3	Test basic performance parameters of hydraulic turbines and pumps and use the acquired knowledge to exhibit competency towards preventive maintenance of the hydraulic equipment	K4

SYLLABUS

1.	Flow through (i) Orificemeter and (ii) Venturimeter
2.	Flow through (i) V Notch and (ii) Rectangular Notch
3.	Bernoullie's Theorem
4.	Major and Minor losses in pipes
5.	Performance test on reciprocating pump
6.	Performance test on single stage centrifugal pump
7.	Impact of jet on vanes
8.	Performance test on pelton wheel

Reference Books:

1.	Fluid Mechanics and Hydraulic Machines by Dr. R.K.Bansal
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Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2206	PC	--	--	3	1.5	15	35	3 Hrs.
MACHINETOOLSLAB								
(For ME)								
Course Objectives:								
1.	To understand the parts of various machine tools and operate them.							
2.	To understand the different shapes of products that can be produced on these machinetools.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1	Distinguish various machining operations on Lathe, Shaper and Milling.							K4
2	Analyze the shear angle, tool tip temperature and surface roughness by applying the knowledge of metal cutting.							K4
SYLLABUS								
1.	Perform step turning & taper turning on a given specimen.							
2.	Perform Knurling and thread cutting on a given specimen.							
3.	Perform form turning and thread cutting on a given specimen.							
4.	Perform eccentric turning on a given specimen.							
5.	Machining of horizontal, vertical, step and angular surface on a shaper machine.							
6.	Perform Gear Cutting on a milling machine.							
7.	Analyze the cutting tool tip temperature in turning.							
8.	Inspect the single point cutting tool angles.							
9.	Measurement of surface roughness.							
Reference Books:								
1.	Elements of Workshop Technology Vol-2 Manufacturing Processes by S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy, MPP, Pvt. Ltd.							
2.	Manufacturing Technology-Foundary, Forming and Welding by P.N. Rao, Tata McGraw Hill Publishing Company.							

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2207	PC	--	--	3	1.5	15	35	3 Hrs.
MECHANICAL ENGINEERING LAB								
(For ME)								
Course Objectives:								
1.	To evaluate various viscosities of lubricating oils							
2.	Ability to understand the working of two stroke and four stroke engines.							
3.	The way of determination of carbon residue, flash and fire points of oil samples.							
4.	To determine the moment of inertia of a compound pendulum and modulus of rigidity of a wire.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1	Assess the environmental, societal safety and health issue through determining the flash & fire point of various lubricating oils as well as fuels, along with computing the viscosity of lubricating oils							K3
2	Functioning and communicating as an individual in a team to write and prepare effective reports on experiments conducted in the laboratory							K6
SYLLABUS								
1.	Study of the variation of viscosity w.r.t temperature for the given sample of mono-grade lubricating oil expressed as a time of flow in seconds by means of various viscometers.							
2.	Determination of the Flash point & Fire point of the given sample of lubricating oil by the Cleveland's open cup apparatus.							
3.	Determination of the Flash point of the given sample of lubricating oil by the Pensky Martins apparatus.							
4.	To draw the valve timing diagram of a given 4-stroke petrol or diesel Engine model.							
5.	To draw the Port timing diagrams 2-stroke petrol engine model.							
6.	Determine the moment of inertia of a bar about an axis passing through its center of gravity by oscillation as a compound pendulum							
7.	Evaluate the modulus of rigidity of the material of the wire by Torsional Oscillations.							
8.	Determine the amount of carbon residue present in a given sample of lubricating oil.							
Reference Books:								
1.	Engineering Mechanics by S.Timoshenko and D.HYoung McGraw-Hill.							
2.	Internal Combustion Engines by V. Ganesan, McGraw-Hill.							

Code	Category	L	T	P	C	I.M	E.M	Exam
B20ME2208	SC	1	--	2	2	--	50	3 Hrs.
ADVANCED SURFACE AND ASSEMBLY MODELING USING CATIA								
(Skill Oriented Course)								
Course Objective:								
1.	To develop skill to use software to create 2D and 3D models.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1	Can use interface of CATIA.							K3
2	Can use command panel, menus, viewports and command icons in CATIA							K3
3	Can create two dimensional drawings in CATIA							K4
4.	Can create 3D part drawings using commands in CATIA							K4
SYLLABUS								
Session 1	Geometrical Shape Design (GSD) introduction to workbench Creation of surfaces							
Session 2	Practice of extrude, revolve and primitive tools							
Session 3	Creating basic curves (wireframe) Practice of circles, spline, helix and spiral							
Session 4	Creating surfaces from surfaces Practice of blend, multi-sections & fill							
Session 5	Trimming surfaces Practice of splitting and trimming of surfaces							
Session 6	Creating curves on surfaces, connect curves, iso-parametric, conic and corners Basic GSD operations Practice 3 to 4 GSD components							
Session 7	Projections Advanced GSD operations, conversion of surfaces to solids Practice 3 to 4 sheet metal components							
Session 8	Assembly introduction to workbench Importing of parts and products Practice of product structure tool with basic assembly Assembly constraints							
Session 9	Practice of various constraint tools Types of Assembly approach Top down assembly and Bottom up assembly							
Session 10	Creating 2 to 3 assemblies with top down and bottom up approach							
Reference Books:								
1.	Engineering Drawing, by N.D.Bhatt, Charotal Publishing House.							
2.	Machine Drawing, by N.D.Bhatt, Charotal Publishing House.							
3.	CATIA Lab Manual.							

Code	Category	L	T	P	C	I.M	E.M	Exam
B20MC2201	MC	2	--	--	--	--	--	--
ENGLISH PROFICIENCY								
(Common to CE,EEE,ME,AIDS & CSBS)								
Course Objectives: The students will be able to								
1.	Communicate their ideas and views effectively							
2.	Practice language skills and improve their language competency.							
3.	Know and perform well in real life contexts							
4.	Identify and examine their self-attributes which require improvement and motivation.							
5.	Build confidence and overcome their inhibitions, stage fright, nervousness etc.,							
6.	Improve their reading skills.							
Course Outcomes: At the end of the course students will be able to								
S.No	Outcome							Knowledge Level
1.	Improve speaking skills.							K3
2.	Enhance their listening capabilities							K3
3.	Learn and practice the skills of composition writing.							K3
4.	Enhance their reading and understanding of different texts.							K3
5.	Improve their communication both in formal and informal contexts.							K3
6.	Be confident in presentation skills.							K3
SYLLABUS								
UNIT-I	Listening Skills Types of listening Hearing and Listening Listening as a receptive skill							
UNIT-II	Speaking Skills Presentation skills Describing event/place/thing Extempore Debate Group Discussion							
UNIT-III	Reading Skills Types of Reading (Intensive and Extensive reading, Skimming, Scanning) Reading/Summarizing News Paper Articles							
UNIT-IV	Writing Skills Essay Writing (Argumentative, Analytical and Descriptive) E-Mail Writing Business Letters Resume Writing							
UNIT-V	Integrated Language Skills Listening Skills for Speaking and Writing Reading Skills for Writing and Speaking							

Reference Books:	
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| 1. | Fundamentals of Technical Communication by Meenakshiraman, Sangeta Sharma of OUP |
| 2. | English and Communication Skills for Students of Science and Engineering, by S.P. Dhanavel, Orient Blackswan Ltd. 2009 |
| 3. | Enriching Speaking and Writing Skills, Orient Blackswan Publishers. |
| 4. | The Oxford Guide to Writing and Speaking by John Seely OUP. |
| 5. | Effective Technical Communication by M.AshrafRizwi. Tata Mcgraw hill. |
| 6. | Six Weeks to Words of Power by Wilfred Funk. W.R.Goyal Publishers |

Note: Internal Assessment is carried out throughout the semester.
