Estd:1980

SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)

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

MECHANICAL ENGINEERING

(Accredited by NBA)

SCHEME OF INSTRUCTION & EXAMINATION

(Regulation R19)

II/IV B.TECH

I-SEMESTER

(With effect from **2019-2020**Admitted Batch onwards**)**

Subject Code	Name of the Subject	Category	Cr.	L	T	P	Internal Marks	External Marks	Total Marks
B19 BS 2101	Mathematics-III	BS	3	3	--	--	25	75	100
B19 ME 2101	Strength of Materials	PC	3	3	--	--	25	75	100
B19 ME 2102	Engineering Thermodynamics	PC	3	3	--	--	25	75	100
B19 ME 2103	Manufacturing Processes	PC	3	3	--	--	25	75	100
B19 ME 2104	Metallurgy and Materials Science	PC	3	3	--	--	25	75	100
B19 ME 2105	Mechanical Engineering Drawing	PC	3	2	--	2	25	75	100
B19 ME 2106	Mechanical Engineering Lab	PC	1.5	--	--	3	20	30	50
B19 ME 2107	Manufacturing Processes Lab	PC	1.5	--	--	3	20	30	50
B19 MC 2101	Professional Ethics and Human Values	MC	--	3	--	--	--	--	--
B19 MC 2104	Introduction to Machine Learning using Python	MC	--	2	--	2	--	--	--
		TOTAL	**21**	**22**	**--**	**10**	**190**	**510**	**700**

Code	Category	L	T	P	C	I.M	E.M	Exam
B19BS2101	**BS**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

MATHEMATICS-III
(Multivariable Calculus and Fourier Analysis)

Pre requisites: Concepts of Calculus

Course Objectives: The students are expected to learn:

1.	How to expand a periodic function in a Fourier series.
2.	How to find Fourier transform for a given function and evaluate some real definite integrals.
3.	Evaluation of Multiple integrals; definitions of Beta, Gamma and error functions.
4.	Concepts of Gradient, divergence and curl and second order operators.
5.	To evaluate line integral, compute work done by a force and Flux of a vector function
6.	Green's, Stokes' and Gauss divergence theorems.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Determine Fourier series and half range series of functions.	K3
2	Determine different Fourier transforms of non-periodic functions and also use them to evaluate integrals.	K3
3	Use the knowledge of Beta and Gamma functions in evaluating improper integrals.	K3
4	Evaluate double integrals, simple triple integrals & find areas and volume.	K3
5	Determine the gradient of a scalar function, divergence and curl of a vector function. Determine scalar potential.	K3
6.	Apply Green's, Stokes' and Gauss divergence theorems to solve problems.	K3

SYLLABUS

UNIT-I (10 Hrs)	**Fourier Series** Introduction, Periodic functions, Fourier series of a periodic function, Dirichlet's conditions, Even and odd functions, Change of interval, Half-range sine and cosine series.
UNIT-II (10 Hrs)	**Fourier Transforms** Fourier integral theorem (without proof), Complex form of Fourier integral, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms, Finite Fouriertransforms, properties, inverse transforms, Parseval's Identities.
UNIT-III (12 Hrs)	**Single and Multiple integrals** Beta and Gamma functions, Properties, Relation between Beta and Gamma functions, Applications: evaluation of improper integrals, error function and the complimentary error function. Double and triple integrals, change of variables, Change of order of integration. Applications: Areas and volumes.

UNIT-IV (10Hrs)	**Vector Differentiation** Gradient, directional derivative, Divergence, Curl, Incompressible flow, solenoidal and irrotational vector fields, vector identities.
UNIT-V (10Hrs)	**Vector Integration** Line integral, Work done, Potential function; Area, Surface and volume integrals, Flux. Vector integral theorems: Green's, Stokes' and Gauss Divergence theorems (without proof) and related Problems.
Text Books:	
1.	**B.S.Grewal,** Higher Engineering Mathematics, 43rd Edition, Khanna Publishers.
	N.P.Bali& Manish Goyal, Engineering Mathematics, Lakshmi Publications.
Reference Books:	
1.	**MichaelGreenberg,** Advanced Engineering Mathematics, 9th edition, Pearson edn.
2.	**Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.
3.	**Peter O'Neil,** Advanced Engineering Mathematics,7th edition, Cengage Learning.
4.	**D.W. Jordan and T. Smith,** Mathematical Techniques, Oxford University Press.
5.	**Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press.
6.	**Dass H.K., Rajnish Verma. Er., H**igher Engineering Mathematics, S. Chand Co. Pvt.Ltd, New Delhi.

Subject Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2101	**PC**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

STRENGTH OF MATERIALS

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, beams and circular shafts; stress and strain transformation
5.	Analyze determinate axial structural members, torsional members, and beams, torque, shear forces, and bending moments.

Course Outcomes

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 calculating principal stresses.	K3
2.	Construct and interpret Shear Force and Bending Moment Diagrams for statically determinate beams under different loading conditions.	K3
3.	Determine stresses due to bending of beams subjected to different loads.	K3
4.	Understand the concepts of strain energy under different loading conditions, and Examine the stresses produced in circular shafts subjected to twisting moments.	K3
5.	Solve for stresses and strains produced in thin and thick walled pressure vessels.	K3

SYLLABUS

UNIT-I (12 Hrs)	**Simple Stresses:** Stress, Strain, Stress-Strain curve, Lateral strain, Bars of varying cross-section, Compound bars, Temperature stresses in bars, Modulus of Rigidity, Complementary Shears. **Complex Stresses:** Stresses acting on an inclined plane under uniaxial and biaxial state of stress, Principal planes and Principal stresses, Mohr's circle for biaxial stresses.
UNIT-II (12 Hrs)	**Shear Forces and Bending Moments:** Beam - Types of loads, Types of supports, types of beams, Shear Force and Bending Moment, S.F. and B.M. diagrams for cantilever, simply supported and over hanging beams loaded with point loads, Uniform Distributed loads and Moments, Relationship between Rate of Loading, Shear Force and Bending Moment
UNIT-III (12 Hrs)	**Stresses in Beams**: Theory of bending, Flexural formula, Determination of bending stresses- section modulus of rectangular, circular, I, and T sections, Determination of simple beam sections, Shear stresses in beams, shear stresses distribution across various beams sections like rectangular, circular, I and T.
UNIT-IV	**Elastic Constants and Stain Energy:** Bulk modulus, Relationship between elastic

(12 Hrs)	constants, Strain energy, Impact Load. **Torsional Stresses in Shafts:** Analysis of torsional stresses, Power transmitted, combined bending and torsion
UNIT-V (12 Hrs)	**Thin Cylinders and Spherical Shells**: Stresses and strains in thin cylinders, thin spherical shell- derivation for longitudinal and circumferential stresses and volumetric strains. **Thick Cylinders:** Lame's equation- Cylinders subjected to inside and outside pressures- compound cylinders.

Text Books:	
1.	Analysis of Structures, by Vazirani and Ratwani, Vol. 1, 1993 edition.
2.	Solid Mechanics, by Popov
Reference Books:	
1.	Strength of Materials, by Timoshenko.
2.	Strength of Materials -By Jindal, Umesh Publications.
3.	Mechanics of Structures Vol-III, by S.B.Junnarkar.

Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2102	**PC**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

ENGINEERING THERMODYNAMICS

Course Objectives: Students are expected to

1.	Expose thermodynamic concepts like thermodynamic system, its boundary, related fundamental definitions and properties of various perfect gases.
2.	Learn the first law of thermodynamics, which is also the energy conservation principle, and should be able to apply to different thermodynamic systems
3.	Educate the use of working principle of combustion engines (internal and external) and their cycles such as Otto, Diesel, Atkinson, Ericson, etc., and their comparison.
4.	Educate the use of Maxwells relations,availability and irreversibility and thermodynamic functions

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Apply the thermodynamic concepts in real life systems and compute properties of various perfect gases.	K3
2	Analyze the first law of thermodynamics to various thermodynamic systems undergoing different thermodynamic processes	K4
3	Applythe second law of thermodynamics to working of various heat engine and thermal efficiency of air standard cycles	K3
4	Analyze the general relation of thermodynamic functions, availability and irreversibility	K4

SYLLABUS

UNIT-I (8 Hrs)	**Unit-I: 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, Causes of Irreversibility – 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-Vanderwall's equation of state- Compressibility charts-
UNIT-II (10Hrs)	**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- Variable specific heats
UNIT-III (10Hrs)	**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 (9Hrs)	**Air standard Cycles**-Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericson Cycle, Brayton cycle – Description and representation on P–V and T-S diagram, Thermal Efficiency, Mean Effective Pressures on Air standard basis – Comparison of Otto-Diesel and Dual cycles based on same compression ratio- same maximum pressure and same maximum temperature.
UNIT-V (9Hrs)	**General Relations, Availability and Unavailability-**Helmholtz function and Gibbs function, Maxwell's equations- Tds relations, relation between specific heats, Available energy, unavailable energy, Available and unavailable forms of energy for a flow and non-flow process-irreversibility

Text Books:	
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.
Reference Books:	
1.	Engineering Thermodynamics by Radhakrishnan, Prentice - Hall India.
2.	An Introduction to Thermodynamics by Y.V.C. Rao, New Age Publications
3.	Engineering Thermodynamics by K. Ramakrishna, Anuradha Publishers
4.	Thermodynamics-An Engineering Approach by Y Cengel& Boles.

Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2103	**PC**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

MANUFACTURING PROCESSES

Course Objectives: Students are expected to

1.	Acquaint the student with the basics of manufacturing engineering.
2.	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:

S.No	Outcome	Knowledge Level
1	Analyze various factors involved in casting process for mould preparation, casting methods, melting, gating system design and casting defects.	K3
2	Identify various cold and hot working processes such as rolling, extrusion, drawing, spinning.	K3
3	Analyze various sheet metal operations and forging techniques.	K3
4	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 laddels; Element of gating system, casting defects.
UNIT-II (8 Hrs)	**Special Casting Techniques**: Permanent mould casting, Pressure die casting, Centrifugal casting, Shell mold casting, Investment casting and CO_2 process.
UNIT-III (8 Hrs)	**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 (8 Hrs)	**Forging Processes**: Forgability, Forging Materials, Classification: smith, drop, press and machine forging, Forging tools, Forging Operations, High energy rate forming, Swaging.
UNIT-V (8 Hrs)	**Welding Processes**: Welding metallurgy, Weldability, Classification: Plastic welding (Forge, Resistance &Thermit welding), Fusion welding (Gas, Arc &Thermit welding), Solid state welding (Friction, Ultrasonic, Diffusion and Explosive welding), Soldering and Brazing, Weld defects, Weld inspection and testing.

Text Books:	
1.	Elements of Workshop Technology Vol-1: Manufacturing Processess by S.K. Hajra Choudhury, A.K. HajraChoudhury,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
B19ME2104	**PC**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

METALLURGYAND MATERIALS SCIENCE

Course Objectives:

1.	To impart knowledge about the engineering materials and their properties and predict their behavior under different working conditions and methods.
2.	To impart knowledge about space lattices, crystal structures and crystal defects.
3.	To acquaint the knowledge about the cooling curves and Phase diagrams of different alloy systems.
4.	To impart knowledge about different heat treatment and surface hardening methods in improving the mechanical properties of steels.
5.	To acquaint knowledge about ferrous & Non-ferrous alloys, particularly Steel and Cast Irons.
6.	To impart knowledge about composite materials, Powder Metallurgy & Nano materials.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Identify the properties of metals with respect to crystal structure and analyze imperfection in crystals.	K2
2	Compute phase change parameters in isomorphous & eutectic systems and Choose appropriate heat-treatment process fulfilling given criteria.	K3
3	Analyze various I.T curves and surface hardening methods to obtain required material properties and list various engineering materials used for the specified applications.	K2
4	Analyze the powder metallurgy process, types and manufacturing methods of composite materials.	K2

SYLLABUS

UNIT-I (10 Hrs)	Structure of crystalline solids: Atomic structure & bonding in solids- Unit cell, Space lattice, Crystal structures and its types-calculations of radius, Coordination Number and Atomic Packing Factor for different cubic structures, Indices for planes and directions - Imperfection in solids, point defects, Line defects, Planar defects and Volume defects- Concept of Slip & twinning,.
UNIT-II (10 Hrs)	Phase diagrams: Basic terms-Solid solutions - Gibbs phase rule- Lever rule – cooling curves-Phase diagrams - construction of phase diagrams- binary phase diagrams - Al-Cu and Al-Si phase diagrams- Invariant reactions, eutectic, peritectic, eutectoid, peritectoid reactions, metatectic& monotectic reactions, Iron carbon phase diagram -Heat treatment of steel-Annealing, and its types, normalizing, hardening, tempering, martemering, austempering.
UNIT-III (10 Hrs)	TTT diagrams, Construction of TTT diagram, TTT diagram for hypoeutectoid and alloy steels, CCT diagram- Martensitic transformation, nature of martensitic transformation-Surface hardening processes like case hardening, carburizing, cyaniding, nitriding, Induction hardening, Flame hardening, hardenabilty, Jominy end-quench test.

UNIT-IV (10 Hrs)	Engineering Alloys: Effect of alloying elements of steel -Properties, composition, and uses of Plain carbon, low carbon, medium & high carbon steels. stainless steels, high speed steels, Hadfield steels, tool steels - Cast irons, gray CI, white CI, malleable CI, SG Cast iron-The light alloys- Al & Mg & Titanium alloys- Copper & its alloys: brasses & bronzes, Smart materials- Nano materials.
UNIT-V (8 Hrs)	Composite Materials: Classification of composite materials, dispersion strengthened, particle reinforced and fiber reinforced composites, laminates properties of matrix and reinforcement materials and structural applications of different types of composite materials – Types of Fabrication of composite materials. Powder Metallurgy: Production of metal powders - Powder Metallurgy process and its applications.
Text Books:	
1.	"Materials Science & Engineering- An Introduction", William D.Callister Jr. Wiley India Pvt. Ltd. 6th Edition, 2006, New Delhi.
2.	"Material Science and Metallurgy for Engineers", Dr. V.D Kodgire and S.V Kodgire
3.	Physical Metallurgy, Principles & Practices", V Raghavan.PHI 2nd Edition 2006, New Delhi.
Reference Books:	
1.	Introduction to Physical Metallurgy by Sidney H AvnerTata McGraw-Hill Education 1997.
2.	Materials Science and Engineering: A First Course By V. Raghavan Phi 5th Edition 2011, New Delhi

Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2105	**PC**	**2**	**--**	**2**	**3**	**25**	**75**	**3 Hrs.**

MECHANICAL ENGINEERING DRAWING

Course Objectives:

1.	To provide an understanding and ability to draw assembly and production drawing of various engine components and machine tool components to the students.
2.	To expose the students to draw various fastenings (temporary, permanent.), Bearings, couplings, key, along with conventional representation and also dimensional and geometrical tolerances etc.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Apply standard empirical formulae for various screw threads, screw fastenings, keys and joints. Identify the various shaft couplings and bearings.	K3
2	Prepare assembly drawing of various mechanical components.	K3
3	Identify various symbols for materials, machining operations and welded joints. Calculate tolerances to obtain various fits. Identify geometrical tolerances and surface finish symbols.	K4
4	Prepare process sheets and production drawings various components	K3

SYLLABUS

Screw threads, Screw Fastenings, keys, and Riveted joints using standard Empirical formulae.

Cotter-joints, Shaft couplings: Box and split muff couplings, Flanged, Flexible, Universal and Oldham couplings,

Assembly drawing of various engine components and machine tool components (Simple eccentric, swivel bearing, plumber block, Screw Jack, Stuffing Box).

Conventional representations, Limits, Fits and Tolerances, Geometrical Tolerances, Indication of surface roughness, Production Drawings.

Text Books:

1.	Machine Drawing, by N.D.Bhatt, Charotal Publishing House.
2.	Production Drawing by K.L Narayan, P. Kannaiah and K. Venkata Reddy, New Age.
3.	Engineering Drawing, by A.C.Parkinson, Wheeler Publishing.

Reference Books:

1.	Machine Drawing by K.L Narayan, P. Kannaiah and K. Venkata Reddy, New Age.

Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2106	**PC**	**--**	**--**	**3**	**1.5**	**20**	**30**	**3 Hrs.**

MECHANICAL ENGINEERING LAB

Course Objectives:

1.	To understand the principle and functioning of various mechanical devices such as boilers, engines etc.
2.	Ability to understand the working of two stroke and four stroke engines.
3.	The way of determination of flash and fire points of oil samples and carbon residue and their importance is acquired.
4.	The procedure for determination of calorific values of the fuels and viscosities of oil samples can be understood.
5.	Practically the procedure for moment of inertia of fly wheel, connecting rod and modulus of rigidity is acquired.

Course Outcomes:

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	K4
2	Functioning and communicating as an individual in a team to write and prepare effective reports on experiments conducted in the laboratory	K4

SYLLABUS

1.	Study and valve timing diagrams for four-stroke and study & PTD of two-stroke engines.
2.	Determination of volumetric efficiency of the given air compressor by (i) plate orifice method and (ii) tank capacity method.
3.	Calibration of the given pressure gauge.
4.	Determination of flash and fire points and b) Canradsons carbon residue test.
5.	Determination of calorific value of flues (solid, liquid and gaseous) by Bomb calorimeter/Gas calorimeter.
6.	Determination of the kinematic and absolute viscosity of the given sample oils.
7.	Determination of inertia of the given flywheel and connecting rod.
8.	Determination of modulus of rigidity of the given wire with torsion pendulum.
9.	Study of boilers, various mountings and accessories.
10.	Assembling of the given two-stroke petrol engine. (Instead of engine, any mechanical unit can be given for this experiment.)

Reference Books:

1.	Engineering Mechanics by S.Timoshenko and D.HYoung McGraw-Hill.
2.	Engineering Mechanics by Singer.
3.	Internal Combustion Engines by V. Ganesan, McGraw-Hill.

Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2107	**PC**	**--**	**--**	**3**	**1.5**	**20**	**30**	**3 Hrs.**

MANUFACTURING PROCESSES LAB

Course Objectives:

1. To impart hands-on practical exposure on manufacturing processes and equipment.

Course Outcomes:

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	K4

SYLLABUS

1. Prepare a Sand mould of stepped pulley
2. Prepare a Sand mould of bend pipe
3. Prepare a Sand mould of flanged pipe
4. Inspect the Grain Fineness number of silica sand.
5. Examine the Moisture and clay content in the given moulding sand.
6. Analyze the Compression strength of moulding sand specimen.
7. Analyze the Hardness of moulding sand specimen.
8. Prepare a S hook using forging operations.
9. Prepare a Vent rod 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
B19MC2101	**MC**	**3**	**--**	**--**	**--**	**--**	**--**	**--**

PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to CSE, IT & Mechanical)

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: Students will be able to:		**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.	K1&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.	K1&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 (8Hrs)	**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.

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.Jayakumaran-Laxmi 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.

Code	Category	L	T	P	C	I.M	E.M	Exam
B19MC2104	**MC**	**2**	**--**	**2**	**--**	**--**	**--**	**--**

INTRODUCTION TO MACHINE LEARNING USING PYTHON

Course Objectives:

1.	To acquire basic programming skills in python.
2.	To develop the ability to use Numpy, Pandas, Matplotlib libraries.
3.	To introduce basic machine learning concepts
4.	To demonstrate basic supervised and unsupervised algorithms in machine learning
5.	To enhance programming capabilities in machine learning using python

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Understand basic fundamentals of python programming	K1
2	Acquire in-sights into Numpy, Pandas & Matplotlib	K1
3	Understand the importance of machine learning	K1
4	Differentiate supervised & unsupervised learning	K2
5	Build his own machine learning algorithm to deal with real data	K3

SYLLABUS

UNIT-I	**Introduction to Python:** About Python, History, Features of Python, Variables, Data Types, Operations, Operators, FOR loops, IF loops, WHILE loops, Python Classes and Python Methods
UNIT-II	**NumPy Arrays, Pandas and Matplotlib:** NumPy arrays, Array creation, Indexing and slicing, Lists, Tuples, Dictionary, Sets, **Pandas Data Frame**: Reading and Writing a Data Frame, Creating and Extracting Features, Conversion of Categorical Data to Numerical Data, Merging Data Frames. **Data Visualization:** Use of Matplotlib Library for Various Plots like Scatter, Bar, Histogram plots, Introduce Various Correlation Techniques.
UNIT-III	**Introduction to Machine Learning:** Introduction to Artificial Intelligence (AI), Machine Learning and Deep Learning, Types of Machine Learning: Supervised, unsupervised & Reinforced Learning, Machine Learning Pipeline: Loading, Preprocessing, Normalizing of Data, Train and Test Split, Evaluation Methods
UNIT-IV	**Various ML Algorithms:** **Supervised:** *Regression:*Simple Linear, Multiple Linear, Polynomial, Logarithmic, Quadratic, Exponential, Sigmoidal Regression**.** *Classification:*Decision Tree, K-Nearest Neighbor, Logistic and Support Vector Machine classifiers. **Unsupervised Learning:** K-means Clustering, Hierarchical Clustering and DBSCAN.

UNIT-V	**Building models:** Building of best machine learning model for 4 different real data
Text Books:	
1.	Phuong Vo.T.H , Martin C, Getting Started with Python Data Analysis, Packt Publishing Ltd.
2.	Charles Severance, Python for Everybody: Exploring Data in Python.
3.	Oliver Theobald, Machine Learning with Python: A Practical Beginner's Guide, Scatterplot Press.
4.	Peter Harrington; Machine Learning in Action, Manning Publications Co.
Reference Books:	
1.	Sabastian R & Vahid M; Python Machine Learning, Packt Publishing Ltd
2.	Jason Bell, Machine Learning: Hands-on for Developers and Technical Professionals, John Wiley & Sons Inc.
3.	Judith H & Daniel K, Machine Learning for Dummies, John Wiley & Sons Inc.
4.	Kent D Lee, Python Programming Fundamentals, Springer-Verlag London Ltd.
5.	Mark Summerfield, Programming in Python 3--A Complete Introduction to the Python Language, Second Edition, Additson Wesley.
Weblinks:	
1.	https://www.py4e.com/book#:~:text=The%20goal%20of%20this%20book%20is%20to%20provide,analysis%20problems%20common%20in%20the%20world%20of%20Informatics.
2.	https://www.allitebooks.in/machine-learning-for-absolute-beginners-2nd-edition/

SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)
(Affiliated to JNTUK, Kakinada), (Recognized by AICTE, New Delhi)
Accredited by NAAC with 'A' Grade, All UG Programmes are Accredited by NBA
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204
Estd:1980

MECHANICAL ENGINEERING
(Accredited by NBA)

SCHEME OF INSTRUCTION & EXAMINATION
(Regulation R19)
II/IV B.TECH
II-SEMESTER
(With effect from **2019-2020**Admitted Batch onwards**)**

Subject Code	Name of the Subject	Category	Cr.	L	T	P	Internal Marks	External Marks	Total Marks
B19 BS 2201	Mathematics-IV	BS	3	3	--	--	25	75	100
B19 ME 2201	Advanced Strength of Materials	PC	3	3	--	--	25	75	100
B19 ME 2202	Applied Thermal Engineering	PC	3	3	--	--	25	75	100
B19 ME 2203	Metal Cutting and Machine Tools	PC	3	3	--	--	25	75	100
B19 ME 2204	Fluid Mechanics	PC	3	3	--	--	25	75	100
B19 HS 2202	Managerial Economics and Financial Accountancy	HS	3	3	--	--	25	75	100
B19 ME 2205	Strength of Materials Lab	PC	1.5	--	--	3	20	30	50
B19 ME 2206	Machine Tools Lab	PC	1.5	--	--	3	20	30	50
B19 MC 2202	Constitution of India	MC	--	3	--	--	--	--	--
		TOTAL	**21**	**21**	**--**	**6**	**190**	**510**	**700**

Code	Category	L	T	P	C	I.M	E.M	Exam
B19BS2201	**BS**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

MATHEMATICS-IV

(COMPLEX VARIABLES AND STATISTICAL METHODS)

Pre-requisites: Basic concepts of Probability and Baye's Theorem

Course Objectives: Students are expected to

1.	Learn the concept of Analytic function and its implications. Applications in Electrostatics and fluid flow problems.
2.	Learn the concepts in complex integration and evaluation of real definite integrals.
3.	Formulate and solve linear difference equations.
4.	Learn important concepts of Z-transform and their use to solve linear difference equations.
5.	Know the concepts of discrete and continuous random variables, learn a few important discrete / continuous probability distributions
6.	Learn Concepts of Sampling theory and develop a framework for testing of hypothesis for getting inferences about Population Parameters.

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

S.No	Outcome	Knowledge Level
1	Comprehend the concept of Analytic function and apply in Electrostatics and Fluid dynamics	**K2**
2	Determine Laurent series of functions about isolated singularities, and determine residues. Use the residue theorem to evaluate certain real definite integrals.	**K3**
3	**Formulate and solve linear difference equations.**	**K2**
4	**Use Z-transforms to solve linear difference equations with constant coefficients.**	**K3**
5	Identify a random variable as discrete/continuous, find its expected value and also fit a probability distribution for a given frequency distribution.	**K3**
6.	Decide the test applicable and apply it for giving inference about Population Parameter based on sample statistic for some large samples and small samples.	**K3**

SYLLABUS

UNIT-I (12Hrs)	**Functions of a Complex Variable** **Review-** Cartesian form and polar form of a complex variable, Real and imaginary parts of z^n, e^z, sin z, sinh z and log z **(no questions may be set on the review portion).** Limit and continuity of a function of a complex variable, derivative, analytic function, entire function, Cauchy- Riemann equations, determine an analytic function based onthe knowledge of its real and imaginary parts, Milne-Thomson method, Applications of analytic function to flow problems, and in Electrostatics. Conformal mapping: thetransformations defined by w = z+c, w = cz, w = 1/z. The Bilinear transformation.
UNIT-II (10Hrs)	**Complex Integration:** Line integral, Cauchy's integral theorem, Cauchy's integral formula. Expansion of a function in a Taylor series, McLaren series and Laurent series. Types of singularities, Residues,

	Cauchy's residue theorem. Evaluation of real definite integrals -integration around unit circle (Theorems without proofs).
UNIT-III (14Hrs)	**Difference equations and Z-transforms:** Formation of a difference equation, Rules for finding complimentary function and particular integral for linear difference equations. Definition of Z- transform, some standard Z- transforms, properties, transform of a function multiplied by n, initial value theorem and final value theorem(without proof), evaluation of inverse Z- transforms, convolution theorem (without proof), solution of linear difference equations by the use of Z- transforms.
UNIT-IV (10Hrs)	**Probability Distributions:** A brief review of random variables, Binomial, Poisson and Normal distributions, definitions of pmf/ pdf, notation, mean, variance, moment generating function. Fitting of Binomial or Poisson distributions for a given frequency distribution.
UNIT-V (12Hrs)	**Sampling theory and Testing of Hypothesis:** **Sampling theory:** Introduction, population and samples, Sampling distribution, standard error, central limit theorem (without proof), level of significance, procedure of testingof hypothesis. **Large samples:** Testing of hypothesis for single proportion and two proportions. **Small samples:** Degrees of freedom, Students' t- distribution, t-test for single mean, two means; Chi- squared distribution, test for goodness of a fit.
Text Books:	
1.	Scope and Treatment as in "Higher Engineering Mathematics", by Dr.B.S.Grewal, 43rd Edition, Khanna Publishers.
2.	Probability and statistics for Engineers, Miller and Freund, 7th edition, Pearson 2008.
Reference Books:	
1.	Fundamentals of Mathematical Statistics by S.C.Gupta and V.K.Kapoor, Sultan Chand & Sons Publishers
2.	Probability and statistics for Engineers and Scientists by Ronald E. Walpole, Sharon L. Myers and Keying Ye, Eighth edition,8th edition, Pearson Education, 2007.
3.	Advanced Engineering Mathematics, by Erwin Kreyszig,Wiley.
4.	Higher Engineering Mathematics, by B.V.Ramana, Tata Mc Graw Hill Company.
5.	A text book of Engineering Mathematics, by N.P.Bali and Dr. Manish Goyal, Lakshmi publications.
6.	Advanced Engineering Mathematics, by H.K.Dass, S.ChandCompany.
7.	Higher Engineering Mathematics, by Dr. M.K.Venkatraman, the National Publishing Company

Subject Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2201	PC	3	--	--	3	25	75	3 Hrs.

ADVANCED STRENGTH OF MATERIALS

Course Objectives: Students are expected to learn

1.	To impart students the knowledge about the calculation of slope and deflection of statically determinate beams.
2.	To enrich the student on the concepts of shear force and bending moment diagrams of fixed beams with uniform and non-uniform cross sections, both under stability of supports and sinking of supports.
3.	To make the student understand the concepts of shear force and bending moment diagrams of continuous beams with uniform and non-uniform cross sections, both under stability of supports as well as sinking of supports.
4.	To analyze the stresses produced in practical applications of curved bars.
5.	To enhance the knowledge of students on different theories applied for analysis of columns and struts.

Course Outcomes

S.No	Outcome	Knowledge Level
1.	Apply the knowledge of mathematics and engineering fundamentals to solve the problems of slope and deflection of statically determinate beams.	K3
2.	Acquire the knowledge of constructing Shear Force and Bending Moment diagrams for fixed Beams.	K3
3.	Acquire the knowledge of constructing Shear Force and Bending Moment diagrams for continuous Beams.	K3
4.	Apply different theories to design the columns and struts subjected to different load conditions.	K4
5.	Investigate various structural members such as curved bars, subjected to different loading conditions for determination of stresses and Strains.	K4

SYLLABUS

UNIT-I (10Hrs)	Deflections of Beams: Relation between curvature, slope and deflection; Slope and deflection of cantilever, simply supported and overhanging beams – Macaulay's method and Moment area method.
UNIT-II (10Hrs)	Fixed Beams: Relations between fixing moments of a fixed beam of uniform cross section, BMD & SFD of fixed beams of uniform and variable cross sections, Effect of sinking of support.
UNIT-III (12Hrs)	Continuous beams: Clapeyron's theorem of three moments for a continuous beam of varying and uniform cross sections, BMD & SFD of continuous beams of uniform cross section, Effect of sinking of support.

UNIT-IV (12Hrs)	Columns and Struts: Buckling of columns, Euler's theory – Columns with both ends hinged, both ends fixed, one end fixed and other end hinged, one end free and other end fixed, Limitation of Euler's formula, Empirical formulae – Rankine's formula, Column carrying eccentric load.
UNIT-V (10Hrs)	Bending of Curved Bars: Winkler-Bach theory of curved bars subjected to uniform bending moment – rectangular, circular, and trapezoidal cross sections, Stresses in a crane hook.

Text Books:	
1.	Analysis of Structures, Vol. – I by Vazirani and Ratwani, Khanna Publishers.
2.	Strength of materials by Sadhu Singh, Khanna Publishers.
Reference Books:	
1.	Strength of Materials, by Timoshenko, CBS Publishers and distributors.
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Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2202	**PC**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

APPLIED THERMAL ENGINEERING

Course Objectives:

1.	To expose the basic principles of steam properties and industrial application of steam
2.	To prepare for basic knowledge of components being used in steam
3.	To taught the design of steam equipment and that R&D in industry is improved.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	**Apply** the laws of thermodynamics for estimating the properties of pure substance	K3
2	**Analyze** the working of vapour power cycles and their performance	K4
3	**Analyze** the functionality of steam nozzle and steam Turbine in power plants to estimate their performance	K4
4	**Apply** 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 diagram, Determination of dryness fraction- Tank or bucket calorimeter, throttling calorimeter, separating and throttling calorimeter.
UNIT-II (8 Hrs)	**Vapor Power Cycles** Vapor power cycle- Rankine cycle- Reheat cycle- Regenerative cycle- Thermodynamic variables effecting efficiency and output of Rankine and Regenerative cycles- Improvements of efficiency, Binary vapor power cycle**.**
UNIT-III (10Hrs)	**Steam Nozzles:** Type of nozzles- Flow through nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles- Relationship between area velocity and pressure in nozzle flow- Steam injectors.
UNIT-IV (10Hrs)	**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- Effect of friction on turbines constructional features governing of turbines.

UNIT-V (8 Hrs)	**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. **Steam Boilers**: Working principle of various boilers their accessories and mountings (Simple vertical, Cochran, Babcock & Wilcox and Lancashire Boiler), Performance of boilers (simple problems)
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.
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.

Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2203	**PC**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

METAL CUTTING AND MACHINE TOOLS

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:

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, broaching and grinding machines.	K3
4	**Distinguish** various Unconventional methods of machining process such as AJM, USM, EDM, ECM.	K3

SYLLABUS

UNIT-I (8 Hrs)	**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 (12Hrs)	**Machine tools using Multi point cutting tools**: **Drilling machine**- Types, Parts, Specifications, Mechanisms, Types of drills, Nomenclatures of twist drill, Operations and machining parameters **Milling machine**-Types, Parts, Specifications, Mechanisms, Attachments, Types of Milling cutters, Nomenclature of plain milling cutter, Operations, machining parameters, Indexing-Differential Indexing method. **Broaching machine**-Types, Parts, Specifications, Types of Broaches, Nomenclature of pull broach, Operations and machining parameters
UNIT-IV (8 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 (8 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), Chemical milling; Photochemical milling, 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. Hajra Choudhury,Nirjhar Roy, MPP, Pvt. Ltd.
2.	Metal cutting and Machine tools by P.N. Rao, Tata McGraw- Hill Publishing Company.
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
B19ME2204	**PC**	**3**	**--**	**--**	**3**	**25**	**75**	**3 Hrs.**

FLUID MECHANICS

Course Objectives: Students are expected to:

1.	Understand the properties of fluids and principles of buoyancy.
2.	Obtain knowledge on types of fluid flow and applications of continuity and Bernoulli's equations.
3.	Gain knowledge on fluid flowing through pipe and dimensional analysis.
4.	Obtain the knowledge on boundary layer principles.
5.	Understandcompressible fluid flow.

Course Outcomes: After the completion of the course, students are 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 apply the concepts of dimensional analysis.	K4
4	Understand and analyze boundary layer concepts.	K4
5	Apply compressible fluid flow theory in solving aerospace and other systems.	K3

SYLLABUS

UNIT-I (10Hrs)	**Properties of fluids**- Introduction-Viscosity- Pressure and its measurement, Absolute, Gauge, Atmospheric and Vacuum pressure – Manometers, Simple manometers, Differential manometers. Hydrostatic forces on surfaces- Total Pressure and Pressure Centre- Vertical, Horizontal, inclined and curved plane surfaces submerged in liquid- Buoyancy andFlotation.
UNIT-II (10Hrs)	**Fluid Kinematics & Fluid Dynamics**: Types of fluid flow- Continuity equation- Velocity potential function and Stream Function- Types of Motion, Linear Translation, Linear deformation, Angular deformation, Rotation, free and forced vortex flow – Euler's equation - Bernoulli's equation and its applications-Venturimeter, Orifice Meter, Pitot tube-Momentum Equation.
UNIT-III (10Hrs)	**Flow through pipes**: Hagen Poiseuille equation- Reynolds experiment - Loss of head due to friction in pipes, Darcy Weisbach equation, Chezy's equation - Minor losses in pipes - pipes in series and pipes in parallel, total energy line-hydraulic gradient line. Flow through branched pipes. **Dimensional and Modeling Analysis**: Fundamental and derived dimensions- Dimensionless groups- Rayleigh method- Buckingham's π-theorem- Model Analysis - Types of similarity- Geometric, Kinematic and Dynamic similarities- Dimensionless numbers- ModelLaws.

UNIT-IV (10Hrs)	**Laminar Boundary Layer:** Definition- Laminar Boundary Layer- Turbulent Boundary Layer - Laminar sub layer- Boundary layer thickness-Displacement thickness, Momentum thickness and Energy thickness-Momentum integral equation- Flow over a flat plate. **Turbulent Boundary Layer**: Laminar, turbulent, transition- Momentum equations and Reynold's stresses- Fully developed turbulent flow through a pipe- Turbulent boundary layer on a flat plate- Laminar sub-layer- Boundary layer separation andcontrol.
UNIT-V (10Hrs)	**Compressible Fluid Flow**: Thermodynamic relations- Continuity, Momentum and Energy equations- Velocity of sound in a compressible fluid- Mach number and its significance- Limits of incompressibility- Pressure field due to a moving source of disturbance- Propagation of pressure waves in a compressible fluids-Stagnation properties- Stagnation pressure, Temperature and density- Area velocity relationship for compressibleflow.
Text Books:	
1.	Fluid Mechanics and Hydraulic Machines, by R. K. Bansal, Laxmi publications.
2.	Hydraulics and Fluid Mechanics - P.N. Modi, S.M. Seth 2nd edition, Standard Book House, 2005.
3.	Fluid Mechanics, by A.K. Mohanty, Prentice Hall of India Pvt.Ltd.
Reference Books:	
1.	Fluid Mechanics and Fluid Power Engineering by Dr. D.S. Kumar, S.K. Kataria&Sons.
2.	Foundations of Fluid Mechanics, by Yuan, Prentice Hall of India.
3.	Fluid Mechanics and its Applications, by S. K.Gupta and A.K.Gupta, Tata McGraw Hill, New Delhi.
4.	Fluid Mechanics and Hydraulic Machines by R. K. Rajput, S.Chand& Co.
Weblinks:	
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/

Code	Category	L	T	P	C	I.M	E.M	Exam
B19HS2202	HS	3	--	--	3	25	75	3 Hrs.

MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTANCY

Course Objectives: Students are expected to learn

1.	To Study Economics and Demand Analysis
2.	To Study Concepts of cost and BEP
3.	To understand Market Structures and Pricing
4.	To understand Economic Systems and Business Cycles
5.	To Study Depreciation and Final Accounts

Course Outcomes: Students will be:

S.No	Outcome	Knowledge Level
1	Able to analyse Demand.	K4
2	Able to Calculate BEP	K3
3	Able to understand Pricing Practices	K2
4	Able to understand Economics Systems and Business Cycles	K2
5	Able to Calculate Depreciation and Final Accounts	K3

SYLLABUS

UNIT-I (10Hrs)	**Introduction to Economics:** Wealth, Welfare and Scarce Definitions of Economics; Micro & Macro Economics. **Demand Analysis**: Demand Determinants, Law of Demand and its exceptions. Elasticity of demand – Meaning, types, Significance of Elasticity of Demand, Measurement of price Elasticity of Demand. Need for Demand forecasting, forecasting techniques.
UNIT-II (10Hrs)	**Cost Analysis**: Classification of cost, Elements of cost, Methods of costing (Job costing, Process costing & Unit costing). **Break-Even Analysis(BEA**): Determination of Break-Even Point, Assumptions and Applications.
UNIT-III (10Hrs)	**Market Structures:** Features and price determination under Perfect competition, Monopoly, Monopolistic competition and Oligopoly. **Pricing practices:** Price - meaning, methods of pricing.
UNIT-IV (10Hrs)	**Economic Systems:** Features and Evaluation of Capitalism, Socialism and Mixed Economy. **Business cycles:** Meaning, Phases, Causes & theories of Business Cycle.
UNIT-V	**Depreciation and Financial Accounting:** Depreciation-causes and methods (straight line method, diminishing balance method).

(10Hrs)	**Financial Accounts:** Preparation of Trading Account, Profit & Loss Account and Balance sheet.
Text Books:	
1.	Managerial Economics & Financial Analysis-by Dr.A.R.AryaSri,TMH 2011.
2.	Engineering Economics-by Tarachand,Nem Chand &Bros.Roorke.
Reference Books:	
1.	Modern Economics - by K. K. Dewett,S.Chand&Co,New Delhi.
2.	Principles of Economics-Vrinda Publications(P)Ltd.New Delhi.

Code	Category	L	T	P	C	I.M	E.M	Exam
B19ME2205	**PC**	**--**	**--**	**3**	**1.5**	**20**	**30**	**3 Hrs.**

STRENGTH OF MATERIALS LAB

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:

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 underimpactloads.	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
B19ME2206	**PC**	**--**	**--**	**3**	**1.5**	**20**	**30**	**3 Hrs.**

MACHINE TOOLS LAB

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 machine tools.

Course Outcomes:

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
B19MC2202	**MC**	**2**	**--**	**--**	**--**	**--**	**--**	**3 Hrs.**

CONSTITUTION OF INDIA

Course Objectives:

1.	To Enable the student to understand the importance of constitution
2.	To understand the structure of executive, legislature and judiciary
3.	To understand philosophy of fundamental rights and duties
4.	To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
5.	To understand the central and state relation financial and administrative.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Understand historical background of the constitution making and its importance for building a democratic India.	K2
2	Understand the functioning of three wings of the government ie., executive, legislative and judiciary.	K2
3	Understand the value of the fundamental rights and duties for becoming good citizen of India.	K2
4	Analyze the decentralization of power between central, state and local self-government.	K2
5	Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.	K2
6.	a. Know the sources, features and principles of Indian Constitution. b. Learn about Union Government, State government and its administration. c. Get acquainted with Local administration and Pachayati Raj. d. Be aware of basic concepts and developments of Human Rights. e. Gain knowledge on roles and functioning of Election Commission	K2

SYLLABUS

UNIT-I (8 Hrs)	Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy. **Learning Outcomes: After completion of this unit student will** ● Understand the concept of Indian constitution ● Apply the knowledge on directive principle of state policy ● Analyze the History, features of Indian constitution ● Evaluate Preamble Fundamental Rights and Duties
UNIT-II (8 Hrs)	Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions; **Learning outcomes:-After completion of this unit student will**

	● Understand the structure of Indian government ● Differentiate between the state and central government ● Explain the role of President and Prime Minister ● Know the Structure of supreme court and High court
UNIT-III (8 Hrs)	State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions **Learning outcomes:-After completion of this unit student will** ● Understand the structure of state government ● Analyze the role Governor and Chief Minister ● Explain the role of state Secretariat ● Differentiate between structure and functions of state secretariat
UNIT-IV (8 Hrs)	Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy **Learning outcomes:-After completion of this unit student will** ● Understand the local Administration ● Compare and contrast district administration role and importance ● Analyze the role of Myer and elected representatives of Municipalities ● Evaluate Zillapanchayat block level organisation
UNIT-V (8 Hrs)	Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women **Learning outcomes:-**After completion of this unit student will ● Know the role of Election Commission apply knowledge ● Contrast and compare the role of Chief Election commissioner and Commissiononerate ● Analyze role of state election commission ● Evaluate various commissions of viz SC/ST/OBC and women.

Reference Books:

1.	Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi.
2.	SubashKashyap, Indian Constitution, National Book Trust.
3.	J.A. Siwach, Dynamics of Indian Government & Politics.
4.	D.C. Gupta, Indian Government and Politics.
5.	H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication).
6.	J.C. Johari, Indian Government andPolitics Hans.
7.	J. Raj IndianGovernment and Politics.
8.	M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi.
9.	Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012.

Weblinks:	
1.	www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution
2.	nptel.ac.in/courses/109104074/8
3.	nptel.ac.in/courses/109104045/
4.	nptel.ac.in/courses/101104065/