DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

STUDY & EVALUATION SCHEME WITH SYLLABUS

FOR

B. TECH 2nd YEAR
MECHANICAL ENGINEERING

(Aeronautical Engineering)

(EFFECTIVE FROM THE SESSION: 2019-20)

THIRD SEMESTER													
S. No.	Subject Code	Subject Name	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	KOE031-38/ KAS302	Engg. Science Course/Maths IV	3	1	0	30	20	50		100		150	4
2.	KAS301/ KVE301	Technical Communication/ Universal Human values	2	1	0	30	20	50		100		150	3
			3	0	0								
3.	KAE301	Fundamental of Thermodynamics	3	1	0	30	20	50		100		150	4
4.	KME302	Fluid Mechanics & Fluid Machines	3	1	0	30	20	50		100		150	4
5.	KME303	Material Engineering	3	0	0	30	20	50		100		150	3
6.	KME351	Fluid Mechanics Lab	0	0	2				25		25	50	1
7.	KME352	Material Testing Lab	0	0	2				25		25	50	1
8.	KME353	Computer Aided Machine Drawing-I Lab	0	0	2				25		25	50	1
9.	KME354	Mini Project/ Internship Assessment*	0	0	2			50				50	1
10.	KNC301/ KNC302	Computer System Security/Python Programming	2	0	0	15	10	25		50			0
11.		MOOCs (Essential for Hons.Degree)											
	Total											**950**	**22**

*The Mini Project or Internship (3-4 weeks) conducted during semester break after 2nd Semester, will be assessed during 3rdSemester

FOURTH SEMESTER													
S. No.	Subject Code	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1.	KAS402/ KOE041-48	Maths IV/Engg. Science Course	3	1	0	30	20	50		100		150	4
2.	KVE401/ KAS401	Universal Human Values/Technical Communication	3	0	0	30	20	50		100		150	3
			2	1	0								
3.	KAE401	Introduction to Aeronautical Engineering	3	0	0	30	20	50		100		150	3
4.	KAE402	Fundamental of Manufacturing Technology	3	1	0	30	20	50		100		150	4
5.	KAE403	Strength of Materials	3	1	0	30	20	50		100		150	4
6.	KAE451	Thermodynamics Lab	0	0	2				25		25	50	1
7.	KAE452	Manufacturing Technology Lab	0	0	2				25		25	50	1
8.	KAE453	Measurement & Metrology Lab	0	0	2				25		25	50	1
9.	KNC402/ KNC401	Python Programming/Computer System Security	2	0	0	15	10	25		50			0
10.		MOOCs (Essential for Hons.Degree)											
	Total											**950**	**21**

SEMESTER-III

FUNDAMENTAL OF THERMODYNAMICS

L-T-P
3-1-0

Objectives:

- To learn about work and heat interactions, and balance of energy between system andits surroundings.
- To learn about application of I-law to various energy conversion devices.
- To evaluate the changes in properties of substances in various processes.
- To understand the difference between high grade and low-grade energies and II lawlimitations on energy conversion.

UNIT –I:

Fundamental Concepts and Definitions: Introduction- Basic Concepts: System, ControlVolume,Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Exact & Inexact Differentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Causes of Irreversibility

Energy and its forms, Work and heat (sign convention), Gas laws, Ideal gas, Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases.

Zeroth law of thermodynamics: Concept of Temperature and its' measurement, Temperature scales.

UNIT –II:

First law of thermodynamics: Thermodynamic definition of work, Displacement work and flow work,Displacement work for various non-flow processes, Joules' experiment, First law analysis for closed system (non-flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I. Its applications, Steady flow systems and their analysis, Steadyflow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc.

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Heat engines, Efficiency,Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius. statement of second law of thermodynamics,

UNIT–III:

Application of second law: Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Carnot theorem and it's corollaries,

Thermodynamic Temperature Scale, PMM-II.

Entropy: Clausius inequality, Concept of Entropy, Entropy change of pure substance in differentthermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility,Second law efficiency, Helmholtz & Gibb's function.

UNIT–IV:

Properties of steam and Rankine cycle: Pure substance, Property of Pure Substance (steam),

Triplepoint, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state,

Phase transformation process of water, Graphical representation of pressure, volume

and temperature, P-T & P-V diagrams, T -S and H-S diagrams, use of property diagram, Steam-Tables &Mollier chart, Dryness factor and its measurement, processes involving steam in closed and open systems.

Simple Rankine cycle.

Thermodynamic relations: Conditions for exact differentials. Maxwell relations, Clapeyronequation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic and Isothermal compressibility.

UNIT–V:

Fuels and Combustion: Combustion analysis, heating values, air requirement, Air/Fuel ratio,standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Adiabatic flame temperature.

Boilers: Classifications and working of boilers, boiler mountings and accessories, Draught and itscalculations, air pre-heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance.

Condenser: Classification of condenser, air leakage, condenser performance parameters.

Course Outcomes:

- After completing this course, the students will be able to apply energy balance to systems and control volumes, in situations involving heat and work interactions.
- Students can evaluate changes in thermodynamic properties of substances.
- The students will be able to evaluate the performance of energy conversion devices.
- The students will be able to differentiate between high grade and low-grade energies.

Books and References:

1. Engineering Thermodynamics by P.K.Nag, TMH
2. Thermodynamics by Shavit and Gutfinger, CRC Press.
3. Thermodynamics- An Engineering Approach by Cengel& Boles, TMH.
4. Basic Engineering Thermodynamics, Joel, Pearson.
5. Fundamentals of Engineering Thermodynamics by Rathakrishnan, PHI.
6. Engineering Thermodynamics by Dhar, Elsevier.
7. Engineering Thermodynamics by Onkar Singh, New Age International.
8. Thermodynamics by Prasanna Kumar Pearson
9. Engineering Thermodynamics by C.P. Arora.
10. Engineering Thermodynamics by Rogers and Mayhew, Pearson.
11. Fundamentals of Thermodynamics - Sonntag, Borgnakke and Van Wylen , John Wiley
12. Engineering Thermodynamics by Jones and Dugans, PHI.
13. Fundamentals of Engineering Thermodynamics by Moran, Shapiro, Boettner, &Bailey, John Wiley.

FLUID MECHANICS AND FLUID MACHINES

L-T-P
3-1-0

Objectives:

- To learn about the application of mass and momentum conservation laws for fluid flows.
- To understand the importance of dimensional analysis.
- To obtain the velocity and pressure variations in various types of simple flows.
- To analyze the flow in water pumps and turbines.

UNIT-I:

Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Incompressible flow, Bernoulli's equation and its applications - Pitot tube, orifice meter, venturi meter and bend meter, notches and weirs, momentum equation and its application to pipe bends.

UNIT-II:

Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two- and three-dimensional flows, streamlines, continuity equation for 3D and 1D flows, circulation, stream function and velocity potential. Buckingham's Pi theorem, important dimensionless numbers and their significance.

UNIT-III:

Equation of motion for laminar flow through pipes, Stokes' law, transition from laminar to turbulent flow, turbulent flow, types of turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks. Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sublayer, separation and its control, Drag and lift, drag on a sphere, a two-dimensional cylinder, and an aerofoil, Magnus effect.

UNIT-IV:

Introduction to hydrodynamic thrust of jet on a fixed and moving surface (flat & curve), Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel.

Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.

UNIT-V:

Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics.

Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels, Comparison of centrifugal and reciprocating pumps, Performance characteristics.

Course Outcomes:

- Upon completion of this course, students will be able to mathematically analyze simple flow situations.
- They will be able to evaluate the performance of pumps and turbines.

Books and References:

1. Introduction to fluid mechanics and Fluid machines by S.K Som, Gautam Biswas, S Chakraborty.

2. Fluid mechanics and machines by R.K Bansal
3. Fox & Donald, “Introduction to Fluid Mechanics” John Wiley &Sons Pvt Ltd,
4. Cengel&Cimbala, ”Fluid Mechanics” TMH, New Delhi.
5. White,F.M. ”Fluid Mechanics” TMH, New Delhi.
6. Munsen et al ,”Fundamental of Fluid Mechanics” Wiley Newyork Ltd
7. Garde, R.J., “ Fluid Mechanics”, SciTech Publications Pvt. Ltd
8. I.H. Shames, “Mechanics of Fluids”, McGraw Hill, Int. Student, Education

MATERIALS ENGINEERING

L-T-P
3-0-0

Objectives:

- Understanding of the correlation between the internal structure of materials, theirmechanical properties and various methods to quantify their mechanical integrity andfailure criteria.
- To provide a detailed interpretation of equilibrium phase diagrams.
- Learning about different phases and heat treatment methods to tailor the properties of Fe-Calloys.

UNIT-I:

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids:Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slipsystems, critically resolved shear stress.

Mechanical Property measurement: Tensile, compression and torsion tests; Young'smodulus, relations between true and engineering stress-strain curves, generalized Hooke'slaw, yielding and yield strength, ductility, resilience, toughness and elastic recovery;Hardness: Rockwell, Brinell and Vickers and their relation to strength.

UNIT-II:

Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximumnormal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics:Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: Highcycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of meanstress using the Modified Goodman diagram; Fracture with fatigue, Introduction to non-destructive testing (NDT).

UNIT-III:

Alloys, substitutional and interstitial solid solutions: Phase diagrams: Interpretation of binaryphase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstructural aspects ofledeburite, austenite, ferrite and cementite, cast iron.

UNIT-IV:

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermaltransformation diagrams for Fe-C alloys and microstructure development. Continuouscooling curves and interpretation of final microstructures and properties- austempering,martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame andinduction hardening, vacuum and plasma hardening.

UNIT-V:

Alloying of steel: Properties of stainless steel and tool steels, maraging steels- cast irons;grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze andcupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titaniumalloys.

Course Outcomes:

- Student will be able to identify crystal structures for various materials and understand thedefects in such structures.
- Understand how to tailor material properties of ferrous and non-ferrous alloys.
- How to quantify mechanical integrity and failure in materials.

Books and References:

1. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.

2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.
4. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.

FLUID MECHANICS LAB

L-T-P
0-0-2

Objectives:

- To understand the principles and performance characteristics of flow and thermal devices.
- To know about the measurement of the fluid properties.

List of Experiments:(At least 8 of the following)

1. To determine the coefficient of impact for vanes.
2. To determine coefficient of discharge of an orifice meter.
3. To determine the coefficient of discharge of Notch (V and Rectangular types).
4. To determine the friction factor for the pipes.
5. To determine the coefficient of discharge of venturi meter.
6. To determine the coefficient of discharge, contraction & velocity of an orifice.
7. To verify the Bernoulli's Theorem.
8. To find critical Reynolds number for a pipe flow.
9. To determine the meta-centric height of a floating body.
10. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
11. To show the velocity and pressure variation with radius in a forced vertex flow.

Course Outcomes:

The students who have undergone the course will be able to measure various properties offluids and characterize the performance of fluid/thermal machinery.

MATERIAL TESTING LAB

L-T-P
0-0-2

Objectives:

- To understand the principles and performance characteristics different materials.
- To know about material properties.

List of Experiments: (At least 8 of the following)

1. Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot on the machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact test on impact testing machine like Charpy, Izod or both.
4. Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index test on spring testing machine.
6. Fatigue test on fatigue testing machine.
7. Creep test on creep testing machine.
8. Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion test of a rod using torsion testing machine.
10. Study of NDT (non-destructive testing) methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.

Course Outcomes:

The students who have undergone the course will be able to measure various properties of materials.

COMPUTER AIDED MACHINE DRAWING-I LAB

L-T-P
0-0-2

Objectives:
To provide an overview of how computers can be utilized in mechanical component design.

UNIT-I:
Introduction (1 drawing sheets):
Introduction, classification of machine drawings, principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, lines and rules of dimensioning.
Orthographic Projections (3 drawing sheets):
Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing line problems, principle of visualization of objects, sectional views, full and half sectional views, auxiliary views.

UNIT-II:
Fasteners (2 drawing sheets):
Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints.

UNIT-III:
Riveted joints (1 drawing sheet):
Introduction, rivets and riveting, types of rivets, types of riveted joints, drawing of boiler joints etc.
Free hand sketching (1 drawing sheet):
Introduction, Need for free hand sketching, Free hand sketching of foundation bolts, studs, pulleys, couplings etc.

UNIT-IV:
Assembly drawing (2 drawing sheets):
Introduction to assembly drawing, drawing assembly drawing of simple machine elements like rigid or flexible coupling, muff coupling, Plummer block, footstep bearing, bracket etc.

UNIT-V:
Computer aided drafting (1 drawing):
Introduction to computer aided drafting; advantages and applications of CAD, concepts of computer aided 2D drafting using any drafting software like AutoCAD, Solid Edge, Draft Sight etc., basic draw and modify commands, making 2D drawings of simple machine parts.

Course Outcomes:
Upon completion of this course, the students can use computer and CAD software for modelling mechanical components.
Books and References:
1. Fundamentals of Machine Drawing by Sadhu Singh & Shah, PHI.
2. Engineering Drawing by Bhat, & Panchal, Charotar Publishing House.
3. Machine Drawing with AutoCAD by Pohit and Ghosh, Pearson.
4. Machine Drawing-KL Narayana, P Kannaiah, KV Reddy, New Age.
5. Machine Drawing, N. Siddeshswar, P Kannaiah, VVS Shastry, Tata McGraw Hill.
6. Engineering Drawing, Pathak, Wiley.
7. Textbook of Machine Drawing, K C John, PHI.
8. AutoCAD 2014 for Engineers & Designers, Bhatt, WILEY.

SEMESTER-IV

INTRODUCTION TO AERONAUTICAL ENGINEERING

L-T-P
3-0-0

Objectives:

- To get acquainted with the history and evolution of aircrafts.
- To understand the different types of airfoils and various parts of aircraft.
- To understand various types of aircraft engines and powerplant.
- To understand the various materials and structural components of a typical aircraft.
- To understand the different types of aircraft systems.

UNIT-I:

Introduction: Pre Wright-Brothers era, Wright Flyer, history and evaluation of aircraft. Conventional airplane, progress inairplane design and application, Current status. Other kinds of heavier than air vehicle, helicopter, VSTOL machines, space vehicles, reusable space vehicles and space shuttle. Different parts of airplane, airfoileffect of viscosity concept of boundary layer, boundary layer control, high lift devices.

UNIT-II:

Aerodynamics: Aerodynamic characteristics, types oflifting surface, types of wing plan forms, drag force, lift to drag ratio as efficiency of a lifting surface, lift and drag forces, lift to drag ratio as efficiency of a lifting surface, Aspect ratio, Airplane axis system, forces and moments,Equilibrium of forces developed on wing and horizontal tail. Location of centre of gravity and Centre of pressure. their importance. Elementary performance of airplane, use of elevator, rudder and ailerons.

UNIT-III:

Airplane Propulsion: Requirement of power to fly, balance of forces, various means ofproducing power for forward flight. Introductory thermodynamics required for airplane power plants, piston engines and jet engines, engine airframe compatibility. Propellers Nomenclature, Types of Propellersand theirs uses. Different types of piston and jet engines. Locations of such engines. Rocket engines and various typesof propellants.

UNIT-IV:

Airplane Structures: Configuration of fuselag and wings. evaluation of structure, progress in materials: wooden to all metal airplanes, strength to weight ratio of aircraft materials, importance of weight load factors factors of safetyin aeronautics and aerospace applications. Details of the structural layout of wing, fuselage tail planes. Cockpit and cabinconfiguration. Different types of materials forairplane and engine application. Materials for space vehicles. Advance composite materials.

UNIT-V:

Aircraft Systems: Elementary studies on hydraulic, pneumatic, pressurizing air- conditioningand oxygen systems. Landing gear and control surface actuating system. Aircraft electrical systems, elementary studies of generation and on-board distribution of electricity.

General: Airplane design, type certification and airworthiness certificate, Role of DGCA in airsafety and regulatory authority, accident investigation and rules of maintenance and services.

Course Outcomes:

- After completing this course, the students would be able to recognise various components and systems of an aircraft.
- The students will be able to know the various forces and moments acting on an aircraft.
- The students will be able to understand the working of aircraft engines.

Books and References:

1. Fundamentals of Flight Richard S. Shevel, Prentice Hall.
2. Aircraft Basic Science: Ralph D. Bent & James I, Mackinley.
3. Jet Aircraft Power System: Jack V. Casamassa& Ralph D. Bent.
4. Aircraft Maintenance and Repair Kroes et al, GLENCOE, 1993.
5. Aircraft Aerodynamics: Clark B. Millikan, 1942
6. Introduction to Avionics: P.S. Dhunta, 1997.

FUNDAMENTAL OF MANUFACTURING TECHNOLOGY

L-T-P
3-1-0

Objectives:

- To understand the different types of manufacturing processes.
- To understand various types of machines and machine tools.
- To understand the various types welding and machining.
- To understand the process of metal forming and casting.

UNIT-I:

Introduction: Importance of manufacturing. Economic & technological considerations in manufacturing. Classification of manufacturing processes. Materials & manufacturing processes for Aerospace applications. Locating & Clamping devices & principles. Jigs and Fixtures and its applications.

Tool layout: Shaper, slotter, planer: Construction, operations &drives. Milling: Construction, Milling cutters, up & down milling. Dividing head & indexing. Max chip thickness & power required. Drilling and boring: Drilling, boring, reaming tools. Geometry of twist drills. Lathe: Principle, construction, types, operations, Turret/capstan. Mechanics of metal cutting.

UNIT-II:

Metal Forming Processes: Hot working versus cold working. Work required for forging, Hand, Power, Drop Forging. Analysis of Wire/strip drawing and maximum-reduction, Tube drawing, Extrusion and its application. Condition for Rolling force and power in rolling. Rolling mills & rolled-sections. lubrication and defects in metal forming processes.

Sheet Metal working: Presses and their classification, Die & punch assembly and press work methods and processes. Cutting/Punching mechanism, Blanking vs. Piercing. Compound vs. Progressive die. Flat-face vs Inclined-face punch and Load(capacity) needed. Analysis of forming process like cup/deep drawing. Bending & spring-back.

UNIT-III:

Casting (Foundry): Basic principle & survey of casting processes. Types of patterns and allowances. Types and properties of moulding sand, sand testing. Elements of mould and design considerations, Gating, Riser, Runners, Core. Solidification of casting. Sand casting, defects & remedies and inspection. Cupola furnace. Die Casting, Centrifugal casting, Investment casting, Continuous casting, CO2 casting and Stir casting etc.

Grinding &Super finishing: Grinding wheels, abrasive & bonds, cutting action. Grinding wheel specification. Grinding wheel wear - attritions wear, fracture wear. Dressing and Truing. Max chip thickness and Guest criteria. Surface and cylindrical grinding.Centreless grinding. Super finishing: Honing, lapping and polishing.

UNIT-IV:

Metal Joining (Welding): Various types of Welding. Gas welding & cutting, process and equipment. Arc welding: Power sources & consumables. TIG & MIG processes and their parameters. Resistance welding-spot, seam projection, other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding. Soldering & Brazing. Adhesive bonding. Thermodynamic and metallurgical aspects in welding and weld distortions & defects in welds and remedies. Weld decay in HAZ.

UNIT-V:

Unconventional Metal forming processes: Unconventional metal forming or High Energy Rate Forming (HERF) processes such as explosive forming, electromagnetic, electro-hydraulic forming. Need & benefits, application and working principle of EDM, ECM, LBM, EBM, USM. AJM, WJM. Similarly, non-conventional welding applications such as LBW, USW, EBW, Plasma- arc welding, Diffusion welding, Explosive welding/cladding. Introduction to Hybrid machining processes.

Course Outcomes:

- After completing this course, the students should be able to recognise various types machining processes and machine tools.
- The students will be able to evaluate the different types of forces involved in metal cutting.
- The students will be able to identify various defects in casting and metal forming processes.

Books and References:

1. Manufacturing Science – A. Ghosh and A.K. Mallik,Affiliated East-West Press.
2. Fundamentals of Metal Machining and Machine Tools – Geoffrey Boothroyd, CRC Press.
3. Production Technology - R.K. Jain Khanna Publishers.
4. Introduction to Manufacturing Processes – John A. Schey ,McGraw-Hill.
5. Production Engineering Science - P.C. Pandey,Standard Publishers Distributors.
6. Fundamentals of Metal Cutting & Machine Tools – B.L. Juneja& G.S. ShekhonWiley.
7. Manufacturing Technology Part I and Part II,-Rao,PN, McGraw-Hill.

STRENGTH OF MATERIALS

L-T-P
3-1-0

Objectives:

- To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads.
- To calculate the elastic deformation occurring in various simple geometries for different types of loading.

UNIT-I:

Force System: Force, Parallelogram Law, Lami's theorem, Principle of Transmissibility of forces. Moment of a force, Couple, Varignon's theorem, Resolution of a force into a force and a couple. Resultant of coplanar force system. Equilibrium of coplanar force system, Free body diagrams, Determination of reactions.

Compound stress and strains: Introduction, normal stress and strain, shear stress and strain, stresses on inclines sections, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr's stress circle, three-dimensional state of stress & strain, equilibrium equations, generalized Hook's law, theories of failure. Thermal Stresses.

UNIT-II:

Concept of Centre of Gravity and Centroid and Area Moment of Inertia, Perpendicular axis theorem and Parallel axis theorem.

Stresses in Beams: Pure Bending**,** normal stresses in beams, shear stresses in beams due to transverse and axial loads, composite beams.

Deflection of Beams: Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams

Torsion: Torsion, combined bending & torsion of solid & hollow shafts, torsion of thin walled tubes.

UNIT-III:

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.

Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin ended columns, effect of end conditions on column buckling, Ranking Gordon formulae, examples of columns in mechanical equipment's and machines.

UNIT-IV:

Thin cylinders & spheres: Introduction, difference between thin walled and thick-walled pressure vessels, Thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.

Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders, stresses in rotating shaft and cylinders, stresses due to interference fits.

UNIT-V:

Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and deflection in unsymmetrical bending, determination of shear centre and flexural axis (for symmetry about both axis and about one axis) for I-section and channel section.

Course Outcomes:

- After completing this course, the students should be able to recognise various types loadsapplied on machine components of simple geometry and understand the nature of internalstresses that will envelop within the components.
- The students will be able to evaluate the strains and deformation that will result due to theelastic stresses developed within the materials for simple types of loading.

Books and References:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of material by Gere, Cengage Learning.
3. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, MCGRAW HILL INDIA.
4. Strength of Materials by Pytel and Singer, Harper Collins.
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Timoshenko and Yσungs, East West Press.
7. Introduction to Solid Mechanics by Shames, Pearson.
8. Mechanics of material by Pytel, Cengage Learning.
9. An Introduction to Mechanics of Solids by Crandall, MCGRAW HILL INDIA.
10. Strength of Materials by Jindal, Pearson Education.
11. Strength of Material by Rattan, MCGRAW HILL INDIA.
12. Strength of Materials by Basavajaiah and Mahadevappa, University Press.

THERMODYNAMICS LAB

L-T-P
0-0-2

Objectives:

- To understand the basic laws of thermodynamics.
- To understand the principles and performance of various heat engines and pump.

List of Experiments: (At least 10 of the following)

1. Joule's experiment to validate first law of thermodynamics.
2. Study of determination of Calorific Value of Fuels by using different calorimeters.
3. Determinations of exhaust gas analysis by using Orsat Apparatus.
4. Determination of Dryness fraction by using different Calorimeters Study of Fire Tube boiler.
5. Study of Water Tube boiler.
6. Determination of viscosity of a given fluid.
7. COP test on a vapour compression refrigeration test rig.
8. To examine the relation between temperature and pressure for saturated steam.
9. Study of Joule-Thomson coefficient and inverse curve.
10. Study of Steam Engine Model and Rankine cycle.
11. Study of Boiler Mountings and Accessories.
12. Determine the work done and efficiency of heat engine.

Course Outcomes:

The student who have undergone the course will be able to identify various properties of system.

MANUFACTURING TECHNOLOGY LAB

L-T-P
0-0-2

Objectives:

- To understand the basic manufacturing processes.
- To understand the principles of welding and machining.
- To understand the principles and working of various machines and machine tools.

List of Experiments: (At least 10 of the following)

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. Bolt (thread) making on Lathe machine.
3. Tool grinding (to provide tool angles) on tool-grinder machine.
4. Gear cutting on Milling machine.
5. Machining a block on shaper machine.
6. Drilling holes on drilling machine and study of twist-drill.
7. Study of different types of tools and its angles & materials.
8. Experiment on tool wear and tool life.
9. Experiment on jigs/Fixtures and its uses.
10. Gas welding, Arc and Resistance welding experiment.
11. Soldering & Brazing experiment.
12. Experiment on unconventional machining and welding.
13. Making a mould (with core) and casting.
14. Forging - hand forging processes, power hammer.
15. Press work experiment such as blanking/piercing, washer, making etc.
16. Wire drawing/extrusion on soft material.

Course Outcomes:

The student who have undergone the course will be able to identify various manufacturing processes.

MEASUREMENT & METROLOGY LAB

L-T-P
0-0-2

Objectives:
To understand various measuring instruments and gauges.

List of Experiments: (At least 8 of the following)

1. Study the working of simple measuring instruments- Vernier callipers, micrometre, tachometer.
2. Measurement of effective diameter of a screw thread using 3 wire method.
3. Measurement of angle using sine bar & slip gauges. Study of limit gauges.
4. Study & angular measurement using level protector.
5. Adjustment of spark plug gap using feeler gauges.
6. Study of dial indicator & its constructional details.
7. Use of dial indicator to check a shape run use.
8. Use of dial indicator and V Block to check the circularity and plot the polar Graph.
9. Study and understanding of limits, fits & tolerances.
10. Experiment on measurement of pressure.
11. Study of temperature measuring equipment's.
12. Measurement using Strain gauge.
13. Measurement of speed using stroboscope.
14. Experiment on measurement of flow.
15. Measurement of vibration/power.
16. Experiment on dynamometers.
17 To study the displacement using LVDT.

Course Outcomes:
The student who have undergone the course will be able to learn, how to handle measuring instruments and gauges.