
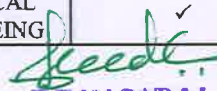


ACADEMIC YEAR (2021-2022)						
		J.K.K.MUNIRAJAH COLLEGE OF TECHNOLOGY T.N.Palayam(po),Gobi(tk)-638506, Erode(dt).				Metric No 1.3.2
S.No	Name of the course	Course code	programme offering			Number of students
				project work	internship	
(2021-2022) Regulation-2017						
1	Project Work	ME8811	MECHANICAL ENGINEERING	✓		1
2	Engineering Thermodynamics	ME8391	MECHANICAL ENGINEERING	✓		1
3	Fluid Mechanics and Machinery	CE8394	MECHANICAL ENGINEERING	✓	✓	3
4	Manufacturing Technology - I	ME8351	MECHANICAL ENGINEERING	✓	✓	1
5	Kinematics of Machinery	ME8492	MECHANICAL ENGINEERING	✓		1
6	Manufacturing Technology – II	ME8451	MECHANICAL ENGINEERING	✓		1
7	Engineering Metallurgy	ME8491	MECHANICAL ENGINEERING	✓	✓	1
8	Strength of Materials for Mechanical Engineers	CE8395	MECHANICAL ENGINEERING	✓		2
9	Thermal Engineering- I	ME8493	MECHANICAL ENGINEERING		✓	1
10	Design of Machine Elements	ME8593	MECHANICAL ENGINEERING	✓	✓	8
11	Metrology and Measurements	ME8501	MECHANICAL ENGINEERING		✓	4
12	Dynamics of Machines	ME8594	MECHANICAL ENGINEERING	✓		3
13	Thermal Engineering- II	ME8595	MECHANICAL ENGINEERING			2
14	Design of Transmission Systems	ME8651	MECHANICAL ENGINEERING	✓		8
15	Computer Aided Design and Manufacturing	ME8691	MECHANICAL ENGINEERING	✓	✓	4



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OBJECTIVE:

- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.
(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

UNIT I BASIC CONCEPTS AND FIRST LAW

9+6

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

UNIT II SECOND LAW AND AVAILABILITY ANALYSIS

9+6

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

9+6

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS

9+6

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties. Compressibility factor-Principle of Corresponding states. -Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

UNIT V GAS MIXTURES AND PSYCHROMETRY

9+6

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL : 75 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

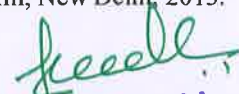
- Apply the first law of thermodynamics for simple open and closed systems under steady , Apply second law of thermodynamics to open and closed systems and calculate entropy , Apply Rankine cycle to steam power plant and compare few cycle improvement methods, Derive simple thermodynamic relations of ideal and real gases, Calculate the properties of gas mixtures and moist air and its use in psychrometric processes

TEXT BOOKS :

- R.K.Rajput, "A Text Book Of Engineering Thermodynamics ",Fifth Edition,2017.
- Yunus a. Cengel & michael a. Boles, "Thermodynamics", 8th edition 2015.

REFERENCES:

- Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.
- Borgnakke & Sonntag, "Fundamental of Thermodynamics", 8th Edition , 2016.
- Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2016.
- Michael J. Moran, Howard N. Shapiro, "Fundamentals of Engineering Thermodynamics", 8th Edition.
- Nag.P.K., "Engineering Thermodynamics", 5th Edition, Tata McGraw-Hill, New Delhi 2013.


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OBJECTIVES

- The properties of fluids and concept of control volume are studied
- The applications of the conservation laws to flow through pipes are studied.
- To understand the importance of dimensional analysis
- To understand the importance of various types of flow in pumps.
- To understand the importance of various types of flow in turbines.

UNIT I	FLUID PROPERTIES AND FLOW CHARACTERISTICS	12
Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.		
UNIT II	FLOW THROUGH CIRCULAR CONDUITS	12
Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli- Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.		
UNIT III	DIMENSIONAL ANALYSIS	12
Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.		
UNIT IV	PUMPS	12
Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps – classification.		
UNIT V	TURBINES	12
Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.		

TOTAL: 60 PERIODS**OUTCOMES:**

Upon completion of this course, the students will be able to

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
- Can mathematically predict the nature of physical quantities
- Can critically analyse the performance of pumps
- Can critically analyse the performance of turbines.

TEXT BOOK:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.

REFERENCES:

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010


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OBJECTIVE:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I METAL CASTING PROCESSES 9

Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces : Blast and Cupola Furnaces; Principle of special casting processes : Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO2 process – Stir casting; Defects in Sand casting

UNIT II JOINING PROCESSES 9

Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding
- Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.

UNIT III METAL FORMING PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes-Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

TOTAL: 45 PERIODS**OUTCOMES:**

- CO1 Explain different metal casting processes, associated defects, merits and demerits CO2
Compare different metal joining processes.
- CO3 Summarize various hot working and cold working methods of metals. CO4
Explain various sheet metal making processes.
- CO5 Distinguish various methods of manufacturing plastic components.

TEXT BOOKS:

- Hajra Choudhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2008
- Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2013

REFERENCES:

- Gowri P. Hariharan, A.Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008
- Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" Eight Edition, Prentice – Hall of India, 1997.
- Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 4th Edition, TMH-2013
- Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006
- Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2014.



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OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS

9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS

9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS

9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT IV GEARS AND GEAR TRAINS

9

Law of toothed gearing – Involute and cycloidal tooth profiles – Spur Gear terminology and definitions – Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS

9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

TOTAL: 45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 Discuss the basics of mechanism
- CO2 Calculate velocity and acceleration in simple mechanisms CO3
Develop CAM profiles
- CO4 Solve problems on gears and gear trains CO5
Examine friction in machine elements

TEXT BOOKS:

1. F.B. Sayyad, "Kinematics of Machinery", MacMillan Publishers Pvt Ltd., Tech-max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms",

REFERENCES:

1. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
3. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3rd Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
4. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
5. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.


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OBJECTIVES:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

UNIT I THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES 9

Shaper - Types of operations. Drilling ,reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling ,hobbing and gear shaping processes – finishing of gears.

UNIT IV ABRASIVE PROCESS AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications
– concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V CNC MACHINING 9

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining.

TOTAL : 45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 Explain the mechanism of material removal processes.
CO2 Describe the constructional and operational features of centre lathe and other special purpose lathes.
CO3 Describe the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.
CO4 Explain the types of grinding and other super finishing processes apart from gear manufacturing processes.
CO5 Summarize numerical control of machine tools and write a part program.

TEXT BOOKS:

- Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters 2014
- Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013.

REFERENCES:

- Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White "Machine Tool Practices", Prentice Hall of India, 1998
- Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 1984
- HMT, "Production Technology", Tata McGraw Hill, 1998.
- Roy. A.Lindberg, "Process and Materials of Manufacture," Fourth Edition, PHI/Pearson Education 2006.



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OBJECTIVE:

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening. .

UNIT III FERROUS AND NON-FERROUS METALS 9

Effect of alloying additions on steel- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT IV NON-METALLIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al_2O_3 , SiC, Si_3N_4 , PSZ and SIALON –Composites- Classifications- Metal Matrix and FRP - Applications of Composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and Charpy, fatigue and creep failure mechanisms.

TOTAL: 45 PERIODS**OUTCOMES**

Upon the completion of this course the students will be able to

- CO1 Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
 CO2 Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
 CO3 Clarify the effect of alloying elements on ferrous and non-ferrous metals CO4 Summarize the properties and applications of non metallic materials.
 CO5 Explain the testing of mechanical properties. .

TEXT BOOKS:

- Avner, S.H., "Introduction to Physical Metallurgy", McGraw Hill Book Company, 1997.
- Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian Edition 2014

REFERENCES:

- Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 2010.
- Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 2015.
- U.C.Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012
- Upadhyay. G.S. and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt. Ltd., New Delhi, 2006.

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OBJECTIVES:

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending – bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION

Torsion formulation stresses and deformation in circular and hollow shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams – Conjugate beam and strain energy – Maxwell's reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lamé's theorem.

TOTAL: 45 PERIODS**OUTCOMES**

Students will be able to

- Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- Apply basic equation of simple torsion in designing of shafts and helical spring
- Calculate the slope and deflection in beams using different methods.
- Analyze and design thin and thick shells for the applied internal and external pressures.

TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009

REFERENCES:

1. Egor. P. Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2002
2. Ferdinand P. Beer, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing 'co. Ltd., New Delhi, 2005.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2013
4. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2010.


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OBJECTIVES:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam.
- Turbines, Compressors and Refrigeration and Air conditioning systems

(Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

UNIT I GAS AND STEAM POWER CYCLES 9

Air Standard Cycles - Otto, Diesel, Dual, Brayton – Cycle Analysis, Performance and Comparison – Rankine, reheat and regenerative cycle.

UNIT II RECIPROCATING AIR COMPRESSOR 9

Classification and comparison, working principle, work of compression - with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors.

UNIT III INTERNAL COMBUSTION ENGINES AND COMBUSTION 9

IC engine – Classification, working, components and their functions. Ideal and actual : Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control.

UNIT IV INTERNAL COMBUSTION ENGINE PERFORMANCE AND SYSTEMS 9

Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common Rail Direct Injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging – Emission Norms.

UNIT V GAS TURBINES 9

Gas turbine cycle analysis – open and closed cycle. Performance and its improvement - Regenerative, Intercooled, Reheated cycles and their combinations. Materials for Turbines.

TOTAL:45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 Apply thermodynamic concepts to different air standard cycles and solve problems. CO2 Solve problems in single stage and multistage air compressors
- CO3 Explain the functioning and features of IC engines, components and auxiliaries. CO4 Calculate performance parameters of IC Engines.
- CO5 Explain the flow in Gas turbines and solve problems.

TEXT BOOKS:

1. Kothandaraman.C.P., Domkundwar. S, Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, "Dhanpat Rai & sons , 2016
2. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2017

REFERENCES:

1. Arora.C.P, "Refrigeration and Air Conditioning , " Tata McGraw-Hill Publishers 2008
2. Ganesan V.. " Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill 2012
3. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.
4. Rudramoorthy, R, "Thermal Engineering " ,Tata McGraw-Hill, New Delhi,2003
5. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007



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THERMAL ENGINEERING – II

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OBJECTIVES:

- To apply the thermodynamic concepts for Nozzles, Boilers, Turbines, and Refrigeration & Air Conditioning Systems.
- To understand the concept of utilising residual heat in thermal systems.

UNIT I	STEAM NOZZLE	9
Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.		
UNIT II	BOILERS	9
Types and comparison. Mountings and Accessories. Fuels - Solid, Liquid and Gas. Performance calculations, Boiler trial.		
UNIT III	STEAM TURBINES	9
Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.		
UNIT IV	COGENERATION AND RESIDUAL HEAT RECOVERY	9
Cogeneration Principles, Cycle Analysis, Applications, Source and utilisation of residual heat. Heat pipes, Heat pumps, Recuperative and Regenerative heat exchangers. Economic Aspects.		
UNIT V	REFRIGERATION AND AIR – CONDITIONING	9
Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, Working principle of air cycle, vapour absorption system, and Thermoelectric refrigeration. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations. Cooling towers – concept and types.		

TOTAL:45 PERIODS**OUTCOMES:****Upon the completion of this course the students will be able to**

- CO1 Solve problems in Steam Nozzle
- CO2 Explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.
- CO3 Explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems.
- CO4 Summarize the concept of Cogeneration, Working features of Heat pumps and Heat exchangers
- CO5 Solve problems using refrigerant table / charts and psychrometric charts

TEXT BOOKS:

- Kothandaraman, C.P., Domkundwar .S and Domkundwar A.V., "A course in Thermal Engineering", Dhanpat Rai & Sons, 2016.
- Mahesh. M. Rathore, "Thermal Engineering", 1st Edition, Tata Mc Graw Hill Publications, 2010.

REFERENCES:

- Arora .C.P., "Refrigeration and Air Conditioning", Tata Mc Graw Hill, 2008
- Ballaney. P.L ." Thermal Engineering", Khanna publishers, 24th Edition 2012
- Charles H Butler : Cogeneration" McGraw Hill, 1984.
- Donald Q. Kern, " Process Heat Transfer", Tata Mc Graw Hill, 2001.
- Sydney Reiter "Industrial and Commercial Heat Recovery Systems" Van Nostrand Reinholds, 1985.



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OBJECTIVES

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components
- (Use of P S G Design Data Book is permitted)

UNIT I	STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS	9
Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.		
UNIT II	SHAFTS AND COUPLINGS	9
Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.		
UNIT III	TEMPORARY AND PERMANENT JOINTS	9
Threaded fasteners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.		
UNIT IV	ENERGY STORING ELEMENTS AND ENGINE COMPONENTS	9
Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.		
UNIT V	BEARINGS	9
Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.		

TOTAL: 45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 Explain the influence of steady and variable stresses in machine component design. CO2 Apply the concepts of design to shafts, keys and couplings.
 CO3 Apply the concepts of design to temporary and permanent joints.
 CO4 Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
 CO5 Apply the concepts of design to bearings.

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2011.

REFERENCES:

1. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010 Ansel
2. Ugural, "Mechanical Design Co, 2003. – An Integral Approach", 1st Edition, Tata McGraw-Hill Book
3. P.C. Gope, "Machine Design – Fundamental and Application", PHI learning private ltd, New Delhi, 2012.
4. R.B. Patel, "Design of Machine Elements", MacMillan Publishers India P Ltd.,


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OBJECTIVES:

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I BASICS OF METROLOGY 9

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS 9

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

UNIT III ADVANCES IN METROLOGY 9

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

UNIT IV FORM MEASUREMENT 9

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE 9

Force, torque, power - mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

TOTAL : 45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to


- CO1 Describe the concepts of measurements to apply in various metrological instruments
- CO2 Outline the principles of linear and angular measurement tools used for industrial applications
- CO3 Explain the procedure for conducting computer aided inspection
- CO4 Demonstrate the techniques of form measurement used for industrial components
- CO5 Discuss various measuring techniques of mechanical properties in industrial applications

TEXT BOOKS:

1. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.
2. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2009.

REFERENCES:

1. Alan S. Morris, “The essence of Measurement”, Prentice Hall of India 1996.
2. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education, 2014.
3. Charles Reginald Shotbolt, “Metrology for Engineers”, 5th edition, Cengage Learning EMEA, 1990.
4. Donald Peckman, “Industrial Instrumentation”, Wiley Eastern, 2004.
5. Raghavendra, Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013.


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OBJECTIVES:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

UNIT I FORCE ANALYSIS

12

Dynamic force analysis – Inertia force and Inertia torque– D Alembert's principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams –Fly Wheels – Flywheels of punching presses- Dynamics of Cam- follower mechanism.

UNIT II BALANCING

12

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines – Balancing of linkages – Balancing machines-Field balancing of discs and rotors.

UNIT III FREE VIBRATION

12

Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration– Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

UNIT IV FORCED VIBRATION

12

Response of one degree freedom systems to periodic forcing – Harmonic disturbances – Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

UNIT V MECHANISM FOR CONTROL

12

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL : 60 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 Calculate static and dynamic forces of mechanisms.
- CO2 Calculate the balancing masses and their locations of reciprocating and rotating masses. CO3 Compute the frequency of free vibration.
- CO4 Compute the frequency of forced vibration and damping coefficient.
- CO5 Calculate the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes.

TEXT BOOKS:

1. F. B. Sayyad, "Dynamics of Machinery", McMillan Publishers India Ltd., Tech-Max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4th Edition, Oxford University Press, 2014.

REFERENCES:

1. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014
2. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3rd Edition Affiliated East-West Pvt. Ltd., New Delhi, 2006.
3. Khurmi, R.S., "Theory of Machines", 1st Edition, S Chand Publications, 2005.
4. Rao.J.S. and Dukupati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
5. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.



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OBJECTIVES:

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues (Use of P S G Design Data Book permitted)

UNIT I	DESIGN OF FLEXIBLE ELEMENTS	9
Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.		
UNIT II	SPUR GEARS AND PARALLEL AXIS HELICAL GEARS	9
Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.		
UNIT III	BEVEL, WORM AND CROSS HELICAL GEARS	9
Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.		
UNIT IV	GEAR BOXES	9
Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.		
UNIT V	CAMS, CLUTCHES AND BRAKES	9
Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.		

TOTAL : 45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 apply the concepts of design to belts, chains and rope drives.
 CO2 apply the concepts of design to spur, helical gears.
 CO3 apply the concepts of design to worm and bevel gears. apply the
 CO4 concepts of design to gear boxes .

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
5. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.


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OBJECTIVES:

- To provide an overview of how computers are being used in mechanical component design
- To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION 9

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation-Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM –CAD/CAM concepts —Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance

UNIT II GEOMETRIC MODELING 9

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III CAD STANDARDS 9

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images- Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

UNIT IV FUNDAMENTAL OF CNC AND PART PROGRAMING 9

Introduction to NC systems and CNC - Machine axis and Co-ordinate system- CNC machine tools- Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types - Detailed Manual part programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.

UNIT V CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS) 9

Group Technology(GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system– Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS

TOTAL : 45 PERIODS**OUTCOMES:**

Upon the completion of this course the students will be able to

- | | |
|-----|---|
| CO1 | Explain the 2D and 3D transformations, clipping algorithm, Manufacturing models and Metrics |
| CO2 | Explain the fundamentals of parametric curves, surfaces and Solids |
| | Summarize the different types of Standard systems used in CAD |
| CO4 | Apply NC & CNC programming concepts to develop part programme for Lathe & Milling Machines |
| CO5 | Summarize the different types of techniques used in Cellular Manufacturing and FMS |

TEXT BOOKS:

1. Ibrahim Zeid “Mastering CAD CAM” Tata McGraw-Hill PublishingCo.2007
2. Mikell.P.Groover “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India, 2008.
3. Radhakrishnan P, SubramanyanS.andRaju V., “CAD/CAM/CIM”, 2nd Edition, New Age International (P) Ltd, New Delhi,2000.

REFERENCES:

1. Chris McMahon and Jimmie Browne “CAD/CAM Principles”, "Practice and Manufacturing management “ Second Edition, Pearson Education, 1999.
2. Donald Hearn and M. Pauline Baker “Computer Graphics”. Prentice Hall, Inc,1992.
3. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education -2003
4. William M Neumann and Robert F.Sproul “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.

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ME8811

PROJECT WORK

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OBJECTIVE:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 300 PERIODS

OUTCOME:

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.



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