

Bachelor of Technology (Mechanical Engineering)

SCHEME OF STUDIES/EXAMINATIONS

Semester – V

S. No.	Course No.	Course Title	Teaching Schedule				Allotment of Marks				Duration of Exam (Hrs.)
			L	T	P	Hours/Week	Theory	Sessional	Practical	Total	
1	ME-301N	I.C. Engine & Gas Turbine	3	1	0	4	75	25	0	100	3
2	ME-303N	Fluid Machines	3	1	0	4	75	25	0	100	3
3	ME-305N	Heat Transfer	3	1	0	4	75	25	0	100	3
4	ME-307N	Industrial Engineering	3	1	0	4	75	25	0	100	3
5	ME-309N	Machine Design-I	2	0	4	6	75	25	0	100	3
6	ME-311N	Production Technology-II	4	0	0	4	75	25	0	100	3
7	ME-313N	I.C. Engine Lab	0	0	2	2	0	40	60	100	3
8	ME-315N	Fluid Machines Lab	0	0	2	2	0	40	60	100	3
9	ME-317N	Heat Transfer Lab	0	0	2	2	0	40	60	100	3
10	ME-319N	Industrial Training (Viva-Voce)*	0	0	0	0	0	40	60	100	3
		Total	18	4	10	32	450	310	240	1000	

**The performance of the student will be evaluated after the presentation delivered and the report submitted by him/her related to Industrial training undertaken after IVth semester.*

Bachelor of Technology (Mechanical Engineering)

SCHEME OF STUDIES/EXAMINATIONS

Semester – VI

S. No.	Course No.	Course Title	Teaching Schedule				Allotment of Marks				Duration of Exam (Hrs.)
			L	T	P	Hours /Week	Theory	Sessional	Practical	Total	
1	ME-302N	Refrigeration and Air Conditioning	3	1	0	4	75	25	0	100	3
2	ME-304N	Tribology & Mechanical Vibration	3	1	0	4	75	25	0	100	3
3	ME-306N	Operation Research	3	1	0	4	75	25	0	100	3
4	CSE-209N	Essentials of IT	3	1	0	4	75	25	0	100	3
5	ME-308N	Computer Aided Design and Manufacturing	4	0	0	4	75	25	0	100	3
6	ME-310N	Machine Design-II	2	0	4	6	75	25	0	100	3
7	ME-312N	Refrigeration and Air Conditioning Lab	0	0	2	2	0	40	60	100	3
8	ME-314N	Tribology & Mechanical Vibration Lab	0	0	2	2	0	40	60	100	3
9	ME-316N	Computer Aided Design and Manufacturing Lab	0	0	2	2	0	40	60	100	3
		Total	18	4	10	32	450	270	180	900	

Note: All the students have to undergo six weeks industrial training after VIth semester and it will be evaluated in VIIth semester.

B. Tech. Vth Semester Mechanical Engineering						
ME-301N	I.C. ENGINE & GAS TURBINE					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
3	1	-	75	25	100	3
Purpose	Detailed study of engines, compressors and gas turbines.					
Course Outcomes						
CO1	Introduction to basic parts of engine and basic cycles.					
CO2	Study of carburettor, injection system and to understand the combustion process.					
CO3	Lubrication system of engine and its performance parameters.					
CO4	To study the compressors and gas turbines.					

UNIT 1

Heat engines; Internal and external combustion engines; Classification of I.C. Engines; Cycle of operations in four strokes and two-stroke IC engines; Wankle Engine.

Air standard cycles: Assumptions made in air standard cycles; Otto cycle; Diesel cycle; Dual combustion cycle; Comparison of Otto, diesel and dual combustion cycles; Sterling and Ericsson cycles; Air standard efficiency, Specific work output. Specific weight; Work ratio; Mean effective pressure; Deviation of actual engine cycle from ideal cycle.

UNIT II

Mixture requirements for various operating conditions in S.I. Engines; Elementary carburetor, Calculation of fuel air ratio; The complete carburetor; Requirements of a diesel injection system; Type of injection system; Petrol injection; Requirements of ignition system; Types of ignition systems, ignition timing; Spark plugs.

S.I. engines; Ignition limits; Stages of combustion in S. I. Engines; Ignition lag; Velocity of flame propagation; Detonation; Effects of engine variables on detonation; Theories of detonation; Octane rating of fuels; Pre-ignition; S.I. engine combustion chambers. Stages of combustion in C.I. Engines; Delay period; Variables affecting delay period; Knock in C.I. Engines; Cetane rating; C.I. Engine combustion chambers.

UNIT III

Functions of a lubricating system, Types of lubrication system; Mist, Wet sump and dry sump systems; Properties of lubricating oil; SAE rating of lubricants; Engine performance and lubrication; Necessity of engine cooling; Disadvantages of overcooling; Cooling systems; Air-cooling, Water-cooling; Radiators.

Performance parameters; BHP, IHP, Mechanical efficiency; Brake mean effective pressure and indicative mean effective pressure, Torque, Volumetric efficiency; Specific fuel consumption (BSFG, ISFC); Thermal efficiency; Heat balance; Basic engine measurements; Fuel and air consumption, Brake power, Indicated power and friction power, Heat lost to coolant and exhaust gases; Performance curves; Pollutants from S.I. and C.I. Engines; Methods of emission control, Alternative fuels for I.C. Engines; The current scenario on the pollution front.

UNIT IV

Working of a single stage reciprocating air compressor; Calculation of work input; Volumetric efficiency; Isothermal efficiency; Advantages of multi stage compression; Two stage compressor

with inter-cooling; Perfect inter cooling; Optimum intercooler pressure; Rotary air compressors and their applications; Isentropic efficiency.

Brayton cycle; Components of a gas turbine plant; Open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; Multi stage compression with inter-cooling; Multi stage expansion with reheating between stages; Exhaust gas heat exchanger; Application of gas turbines.

Text books:

1. Internal combustion engine by Ramalingam sci-tech publication
2. Internal combustion engine by Ganeshan TMG

Reference Books

1. Internal combustion engine by Mathur & Sharma
2. Heat power engineering by Dr. V.P. Vasandhani& Dr. D.S. Kumar

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. V th Semester Mechanical Engineering						
ME-303N	FLUID MACHINES					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time(Hrs.)
3	1	-	75	25	100	3
Purpose	To make students aware of Momentum induced by Jets. Classification, Working & Design of Hydropower Plants, Turbines, Pumps and Hydraulic Machines.					
COURSE OUTCOMES						
CO1	Analysis of Momentum induced by Water Jets on stationary & moving; curved, flat & unsymmetrical single or multiple plates & vanes & on ships. Study of Dimensional Analysis Methods.					
CO2	Classification, Working, Design, Efficiencies, Characteristics & Model Testing of Hydraulic Turbines & study of Hydropower Plant & associated terms.					
CO3	Study of Classification, Working, Design, Efficiencies, Heads & Model Testing of Hydraulic Pumps.					
CO4	Study of various types of Hydraulic Machines.					

UNIT I

IMPULSE MOMENTUM BY WATER JETS: Impact of water jet: On Stationary & Moving Flat & Curved Plates, On Series of vanes Flat & Radial; Ship Propulsion by Jets; Numericals.

DIMENSIONAL ANALYSIS: Units and dimensions; Dimensional homogeneity; Dimensional analysis: Rayleigh Method & Buckingham's Pi-Theorem; Applications & limitations of dimensional analysis; Dimensionless numbers; Similitude laws; Numericals.

UNIT II:

HYDRAULIC TURBINES

INTRODUCTION: Classification of Hydraulic Machines; Hydropower plant & its Components; Surge tank and its type; Classification of turbines; Effective head, available power & Efficiencies.

PELTON TURBINE: Components; Work done & efficiency; Design: Number & Dimensions of Buckets, Speed ratio, Jet ratio, Run-away speed, jet velocity, mean wheel diameter, number of jets, maximum efficiency; Governing; Numericals.

FRANCIS TURBINE: Components; Work done & efficiency; Design: Runner, Width-Diameter ratio, Speed ratio, Flow ratio; Outward vs. Inward flow reaction turbines; Governing; Numericals.

AXIAL FLOW TURBINES: Propeller Turbine; Kaplan turbine; Components, Work done Power & Efficiency, Governing; Draft Tube: Efficiency & Types; Numericals.

DESIGN & OPERATIONAL PARAMETERS: Model testing of turbines; Specific Speed; Unit quantities; Performance Characteristic curves.

UNIT III:

HYDRAULIC PUMPS

CENTRIFUGAL PUMPS: Introduction; Components; Various Heads; Euler's head and its variation with vane shapes; Effect of finite number of vanes; Losses & efficiencies; Minimum starting speed; Limitation of suction lift; Net Positive Suction Head (NPSH); Priming; Cavitation and its effects, Cavitation parameters, Detection and Prevention of Cavitation; Multistage pumps; Specific speed and Performance; Numericals.

RECIPROCATING PUMPS: Introduction; Working principles; Classification; Components; Discharge Coefficient & slip; Work & Power input; Indicator diagram; Effect of Friction,

Acceleration and Pipe friction; Maximum speed; Air vessels; Comparison with centrifugal pumps; Model testing of pumps; Numericals.

UNIT IV:

HYDRAULIC SYSTEMS

PUMPS: Propeller pump; Jet pump; Airlift pump; Gear pump; Screw pump; Vane pump; Radial piston pump; Submersible pump; Pump problems.

MACHINES: Hydraulic accumulators; Hydraulic intensifier; Hydraulic lift; Hydraulic crane; Hydraulic coupling; Torque converter; Hydraulic ram.

Text books:

1. Introduction to fluid mechanics and machinery by Som and Bishwas, TMH
2. A textbook of Fluid Mechanics & Hydraulic Machines by R. K. Bansal, Laxmi Publications

Reference Books:

1. Fluid mechanics and machinery by S. K. Aggarwal TMG
2. Fluid mechanics & fluid power engineering by D.S kumar, Katson publisher
3. Fluid mechanics and Hydraulic machine by S.S rattan, Khanna publisher

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. V th Semester Mechanical Engineering						
ME-305N	<u>HEAT TRANSFER</u>					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
3	1	-	75	25	100	3
Purpose	To familiarize the students with the basic concepts of Heat Transfer.					
Course Outcomes						
CO1	Understand the basic modes of heat transfer and develop the general heat conduction equation.					
CO2	Analyse the one dimensional steady state heat conduction with and without heat generation.					
CO3	Determine the temperature distribution and effectiveness of extended surfaces.					
CO4	Differentiate between free and forced convection and discuss the dimensional analysis of free and forced convection.					
CO5	Understand the concept of hydrodynamic and thermal boundary layer and develop the related equations.					
CO6	Develop knowledge about the laws of thermal radiation and the concept of black body.					
CO7	Classify different types of heat exchangers and discuss LMTD and NTU approaches for the design of heat exchangers.					

UNIT I

Introduction: definition of heat, modes of heat transfer; basic laws of heat transfer, application of heat transfer, simple problems.

Conduction: Fourier equation, electrical analogy of heat conduction; thermal conductivity, the general conduction equation in cartesian, cylindrical and spherical coordinates, steady one dimensional heat conduction without internal heat generation: conduction through plane and composite wall, the cylindrical shell; the spherical shell; critical thickness of insulation; variable thermal conductivity, steady one dimensional heat conduction with uniform internal heat generation: the plane slab; cylindrical and spherical systems, unsteady heat conduction: lumped parameter analysis, introduction to Heisler charts.

UNIT II

Convection: Introduction: Newton's law of cooling, convective heat transfer coefficient, Nusselt number, convection boundary layers: Introduction of velocity and thermal boundary layers and its significance with respect to convection (without derivations of boundary layer equations), local and average convection coefficient, functional form of the solution of boundary layer equations, Physical significance of the dimensionless parameters, Reynolds analogy, **External Forced Convection:** Introduction to empirical method of solution, flow over a flat plate with both conditions of constant heat flux and constant temperature, cylinder in cross flow, flow over a sphere, **Internal Forced Convection:** Introduction to velocity profile, pressure gradient and friction factor in fully developed flow, mean temperature, energy balance considering constant surface heat flux and for constant surface temperature, convection correlations for laminar flow in circular tubes both in entry region and in the fully developed region, **Natural convection:** Physical considerations, governing equations (without derivations), functional form

of the solution of governing equations, empirical correlations for external free convection flow over the vertical plate, horizontal and inclined plates, horizontal cylinder and sphere.

UNIT III

Radiation: fundamental concepts, absorption, reflection and transmission, black body concept, monochromatic and total emissive power, Planck's distribution law, Stefan Boltzman law, Wien's displacement law, Kirchoff's law, intensity of radiation, Lambert's cosine law, heat transfer between black surfaces, radiation shape factor, heat transfer between non-black surfaces: infinite parallel planes, infinite long concentric cylinders, small gray bodies and small body in large enclosure, electrical network approach, radiation shields.

UNIT IV

Extended Surfaces: governing equation for fins of uniform cross section, temperature distribution and heat dissipation rate in infinitely long fin, fin insulated at tip, fin losing heat at tip; efficiency and effectiveness of fins.

Heat Exchangers: classification of heat exchangers; overall heat transfer coefficient, logarithmic mean temperature difference, effectiveness of heat exchangers, NTU method of heat exchanger design, applications of heat exchangers.

Text books:

1. Fundamentals of Heat and Mass transfer – Frank P. Incropera, David P. Dewitt, T.L. Bergman and A.S. Lavine, Wiley Publications.
2. Heat Transfer: A Practical Approach - Yunus A Cengel, Tata McGraw Hill.
3. Heat Transfer – J.P. Holman, Tata McGraw Hill.

Reference Books:

1. A Text book of Heat Transfer - S.P Sukhatme, University press
2. Heat and Mass Transfer - D.S Kumar, S.K. Kataria& Sons
3. Heat and Mass Transfer – P.K. Nag, Tata McGraw Hill.
4. Heat Transfer – Y.V.C. Rao, University Press.
5. Heat Transfer – P.S.Ghoshdastidar, Oxford Press.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. Vth Semester Mechanical Engineering						
ME 307N INDUSTRIAL ENGINEERING						
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
3	1	-	75	25	100	3
Purpose	To give the basic idea of industrial concept.					
Course Outcomes						
CO1	Introduction to different recording charts and technique.					
CO2	Understand the concept of industrial organization & ppc.					
CO3	Introduction, Objectives and importance of sales forecasting & inventory control.					
CO4	Introduction to wages, JIT, SCM, VE, TIME MANAGEMENT.					

UNIT I

Introduction to work study; Method study; Basic procedure, Recording techniques (Charts and diagrams); Elemental breakdown; Micro-motion studies; Therbligs; SIMO- chart principles of motion- economy. Introduction; Objectives; techniques (time) information recording; methods of things, Time study allowances; work sampling technique, Performances rating and its determinant ion technique, Performance rating and its determination PMTS; M.T.M., Work factor.

UNIT II

Principle of organization; Importance and characteristics of organization; Organization theories; Classical Organization theory; Neo-Classical organization theory, modern organization theory; Types of organization. Military or line organization, Functional organization, line and staff organization, Committee objectives of PPC; Functions of PPC Preplanning and planning; Routing; Estimating; scheduling; master schedule; Daily schedule; Gantt chart; Dispatching; centralized vs

UNIT III

Introduction, Objectives and importance of sales forecasting, Types of forecasting, Methods of sales forecasting, Collective opinion method, Delphi technique, economic indicator method; Regression analysis, introduction, Functions of inventory; Types of inventory; Control importance functions, Inventory costs, factors affecting inventory control, Various inventory controls models; A.B.C. analysis, lead-time calculations.

UNIT IV

Introduction, Objective; Concept and life cycle of a product and V.E.; Steps in V.E. Methodology and techniques, Fast diagram, Matrix method. Various concepts in industrial engineering.

- a) WAGES AND INCENTIVES ; Concept ; Types, plans, Desirable characteristics.
- b) SUPPLY CHAIN MANAGEMENT; Its Definition, Concept, Objectives, Applications, Benefits, some successful cases in Indian Industries.

c) JIT; Its definition, concept, importance, misconception, relevance, Applications, Elements of JIT (brief description)

d) TIME MANAGEMENT; Introduction, steps of time management, Ways for saving time KEY for time saving.

REFERENCES AND TEXT BOOKS:

1. Industrial Engg. by M. Mahajan/Industrial Engg. by Savita Sharma.
2. Production planning and control by S. Elion.
3. Modern Production Management by S.S. Buffa.
4. Industrial Engg. and Management manufacturing system by Surender Kumar, Satya Parkashan.
5. Essence of Supply Chain Management by R.P. Monaty and S.G. Deshmukh.
6. Industrial Engg., and management by S. Sharma and Savita Sharma.
7. Industrial Engineering and management by I P Singh, Neelam Publications..

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. V th Semester Mechanical Engineering						
ME-309N MACHINE DESIGN-I						
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
2	-	4	75	25	100	3
Purpose	To understand the fundamentals for solving engineering problems relating to machine components.					
Course Outcomes						
CO1	To design the machine components for static and fluctuating loads.					
CO2	To solve the design problems of different types of joints i.e. riveted joint, welded joint, cotter and knuckle joints under different loading conditions.					
CO3	To solve the design problems of transmission shafts, keys and lever for different loading conditions					
CO4	To solve the design problems of different types of couplings, pipe joints and crane hook.					

UNIT-I

Introduction: Design concepts, overall design considerations, codes and standards, methodology for solving machine component problems. **Engineering materials:** properties, ferrous metals, non-ferrous metals, plastics and composite materials, BIS system of designation of steels, selection of engineering materials.

Design against static load: Modes of failure, factor of safety, stress concentration: causes and mitigation, **Design against fluctuating load:** Fluctuating stresses, endurance limit, low cycle and high cycle fatigue, notch sensitivity, endurance limit-approximate estimation, reversed stresses- design for finite and infinite life, cumulative damage in fatigue, Soderberg and Goodman Lines, Modified Goodman Diagrams.

UNIT-II

Threaded Joints: Basic types of screw fastening, Bolts of uniform strength, locking devices, terminology of screw threads, ISO metric screw threads, materials and manufacture, design of bolted joints, bolted joints with eccentric loads. **Cotter and Knuckle Joints:** design of cotter and knuckle joints.

Riveted and Welded Joints: Riveted joints for boiler shell according to I. B. R., riveted structural joint, eccentrically loaded riveted joint, types of welded joints, strength of welds under axial load, welds under eccentric loading.

UNIT-III

Transmission Shafts: Shaft design on strength basis and torsional rigidity basis, ASME code for shaft design, design of hollow shaft on strength basis and torsional rigidity basis.

Keys: Design of square and flat keys.

Levers: Hand and foot levers, cranked lever, lever for a lever safety valve, Bell crank lever. Miscellaneous levers.

UNIT-IV

Couplings: Types of shaft couplings, design of sleeve or muff coupling, clamp coupling, rigid flange couplings and bushed-pin flexible couplings.

Curved Beams: Design of crane hook. **Pipe Joints:** Design of circular, oval shaped and square flanged pipe joints.

Text books:

1. Mechanical Engineering Design, Joseph E. Shigley and Charles R. Mischke, Tata McGraw Hill Book Co.
2. Design of Machine Element, V. B. Bhandari, Mc Graw Hill Edu. Pvt. Ltd.
3. Machine Component Design, Robert C. Juvinall and Kurt M. Marshek, Wiley India Pvt. Ltd.
4. Mechanical Design of Machine Elements and Machines, Collins and Busby, Wiley India Pvt. Ltd.

References books:

1. Machine Design by Sharma and Aggarwal
2. Machine Design-an integrated Approach, Robert L. Norton, Addison Wisley Longman
3. PSG Design Data Book by PSG college of Engineering, PSG Publication.
4. Design Data Hand book for Mechanical Engineers by K. Mahadevan and K. Balaveera Reddy.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. Vth Semester Mechanical Engineering						
ME-311N	PRODUCTION TECHNOLOGY-II					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
4	-	-	75	25	100	3

Course Outcomes

CO1	To learn about kinematics of machine tools which drives classification of spindle speed on lathe, design of gearbox and geared head stock.
CO2	To understand about thread manufacturing, gear production, generation and various process on gears including gear finishing etc.
CO3	To understand the UCM process and details about machine tool vibrations.
CO4	To analyse jigs and fixtures.

Unit-I

Machine Tool Power Drives:

Power sources used in Machine tools, estimation of power requirement for machine tool Drives, hydraulic drives in machine tools, Role and general constituents of the Kinematics Structure of machine tools, different forms of machine tool kinematic structure, mechanism. Commonly used in machine tool kinematic systems, method of changing speed feed in machine Tools, need of large no of speeds and feed in machine tools, method of changing speed and feed in machine tools.

Design of speed gearbox of machine tool, procedural steps in design of SGB, Layout of spindle speed in machine tools, selection of gear layout and ray-diagram for speed gearbox, determination of dimensions of the gears and shafts of speed gear box.

Unit-II

Thread Manufacturing:

Thread casting, thread chasing, thread rolling, die-threading and tapping, thread milling, thread grinding, thread measurement and inspection.

Gear Manufacturing and finishing:

Introduction, Classification of gear production method, Gear generation processes: gear hobbing, gear shaping, rack planning. Gear finishing methods: shaving, roll finishing, burnishing, grinding, lapping, honing.

Unit-III

Unconventional Machining processes:

Introduction, Need for unconventional processes, Classification of unconventional machining processes, process selection, Abrasive jet machining (AJM), Water jet machining(WJM), Ultrasonic machining(USM), chemical machining (CHM), Electrochemical machining (ECM), Electric discharge machining (EDM), Wire cut EDM, laser beam machining(LBM), Electron beam machining (EBM); their process parameters, Principle of metal removal , applications, advantages and limitations.

Machine Tools vibration:

Introduction, effects of vibration on machine tools, source of vibration, types of machine tool vibrations: and self-excited vibration (chatter), causes of self-excited vibration, chatter prediction, avoidance of chatter and vibration on existing machine tools and on proposed machine tools, vibration control and isolation.

UNIT-IV

Jigs and fixtures:

Introduction to Jig and fixtures, locating and clamping, design principles common to jig and fixtures, types of jig and fixtures, indexing jig and fixtures, automated jigs and fixtures.

Fundamentals jig and fixture design, jig and fixture construction, materials for jig and fixtures, tolerance and error analysis, analysis of clamping forces.

Text books:

1. Machining and machine tools by A.B. Chattopadhyay, Wiley India.
2. Fundamentals of metal cutting and machine Tools by Juneja, New age.
3. A text book of production engineering: Dr. P.C.Sharma, S Chand Technical.

Reference Books:

1. Tool design by Donaldson, TMH.
2. Workshop Technology, vol.-II: B.S.Raghuwanshi, Dhanpat Rai publications.
3. Production Technology: R.K. JAIN, Khanna Publishers.
4. Machine Tools: Dr. R. Kesavan & B.Vijaya, Ramnath, Laxmi publications.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. Vth Semester Mechanical Engineering							
ME-313N	I. C. Engine Lab						
Lecture	Tutorial	Practical	Theory	Sessional	Practical	Total	Time(Hrs.)
-	-	2	-	40	60	100	3
Purpose	To understand the performance of C. I. and S. I. engines. Also to study cooling towers, boiler and detail parts of I C engines.						
COURSE OUTCOMES							
CO1	To understand the principle, construction and working of S.I. and C.I. engine.						
CO2	To calculate the performance parameters of reciprocating air compressor, petrol and diesel engine.						
CO3	To study lubrication, cooling systems of I C engine. Also to understand the braking system of automobile.						
CO4	To study boiler performance, fuel injection system of C I engine and brake ignition system of S I engine.						

LIST OF EXPERIMENTS

1. To make a trial on single cylinder 4-stroke Diesel Engine to calculate B. H. P., S.F.C. and to draw its characteristics curves.
2. To make a trial on 4-stroke high-speed diesel engine and to draw its Heat Balance Sheet.
3. To make a trial on Wiley's jeep Engine at constant speed to calculate B. H. P., S. F. C. Thermal efficiency and to draw its characteristic Curves.
4. To make Morse Test to calculate IHP of the multi cylinder petrol engine and to determine its mechanical efficiency.
5. To calculate the isothermal efficiency and volumetric efficiency of a 2 stage reciprocating air compressor.
6. To find out the efficiency of an air Blower.
7. To make a trial on the Boiler to calculate equivalent evaporation and efficiency of the boiler.
8. To study the following models;
(a) Gas Turbine (b) Wankle Engine.
9. To study
(a) Lubrication and cooling systems employed in various I. C. Engines in the Lab
(b) Braking system of automobile in the lab
10. To study a Carburetor.
11. To study (I) the Fuel Injection System of a C. I. Engine. (II) Battery Ignition system of a S.I. Engine
12. To study Cooling Tower.
13. To study multi Cylinder four strokes vertical Diesel Engine test RIG With Hydraulic Dynamometer.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

B. Tech. Vth Semester Mechanical Engineering							
ME-315N	FLUID MACHINES LAB						
Lecture	Tutorial	Practical	Theory	Sessional	Practical	Total	Time(Hrs.)
-	-	2		40	60	100	3
Purpose	To provide students with practical knowledge of working of Hydraulic Turbines, Pumps and Machines.						
COURSE OUTCOMES							
CO1	Students will gain knowledge of the practical working of various hydraulic turbines.						
CO2	Students will gain knowledge of the practical working of various hydraulic pumps.						
CO3	Students will gain knowledge of the practical working of various hydraulic machines.						

LIST OF EXPERIMENTS

1. To study and perform test on the Pelton wheel and to plot curves Q, P Vs N at full, three fourth gate opening.
2. To study and perform test in the Francis Turbine and to plot curves Q, P Vs N at full, three-fourth gate opening.
3. To study and perform test on the Kaplan Turbine and to plot curves Q, P Vs N at full, three-fourth half opening.
4. To study and perform test on Centrifugal Pump and to plot curves η , Power Vs Q.
5. To study and perform test on a Hydraulic Ram and to find its Rankine, Aubussion η .
6. To study and perform test on a Reciprocating pump and to plot the P and η Vs H.
7. To study and perform test on a Gear Pump and to plot the curves Q.P Vs Pressure rise.
8. Study and perform test on a Torque Convertor and to plot the curves η & N_p .
9. To study and perform test on Submersible Pump and to plot curves η , Power Vs Q.
10. To study and analyse experimentally the Impact of Jet on flat vanes.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

B. Tech. Vth Semester Mechanical Engineering							
ME-317N	HEAT TRANSFER LAB						
Lecture	Tutorial	Practical	Theory	Sessional	Practical	Total	Time (Hrs.)
-	-	2	-	40	60	100	3
Purpose	To familiarize the students with the equipments and instrumentation of Heat Transfer.						
Course Outcomes							
CO1	Design and conduct experiments, acquire data, analyze and interpret data.						
CO2	Measure the thermal conductivity of metal rod, insulating material and liquids.						
CO3	Understand the concept of composite wall and determine its thermal resistance.						
CO4	Plot the temperature profile in free and forced convection.						
CO5	Measure the performance of a heat exchanger.						
CO6	Understand the concept of solar heating and measure the performance of solar equipments.						

LIST OF EXPERIMENTS:

1. To determine the thermal conductivity of a metal rod.
2. To determine the thermal conductivity of an insulating slab.
3. To determine the thermal conductivity of a liquid using Guard plate method.
4. To determine the thermal conductivity of an insulating powder.
5. To determine the thermal resistance of a composite wall.
6. To plot the temperature distribution of a pin fin in free-convection.
7. To plot the temperature distribution of a pin fin in forced-convection.
8. To study the forced convection heat transfer from a cylindrical surface.
9. To determine the effectiveness of a concentric tube heat exchanger.
10. To determine the Stefan-Boltzman constant.
11. To determine the critical heat flux of a given wire.
12. To study the performance of glass in glass solar collector.
13. To study the performance of an evacuated tube based solar water heater.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

B. Tech. Vth Semester Mechanical Engineering								
ME-319N INDUSTRIAL TRAINING (VIVA-VOCE)								
Lecture	Tutorial	Practical	Credit	Theory	Sessional	Practical	Total	Time (Hrs.)
-	-	-	-	-	40	60	100	3

Student will submit summer training (about 8 weeks industrial training) report and Viva-voce will be conducted for his/her assessment.

B. Tech. VIth Semester Mechanical Engineering						
ME-302N REFRIGERATION AND AIR-CONDITIONING						
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
3	1	-	75	25	100	3
Purpose	The objective of this course is to make the students aware of refrigeration, Air-conditioning, various methods of refrigeration. The course will help the students to build the fundamental concepts in order to solve engineering problems and to design HVAC applications.					
Course Outcomes						
CO 1	Understanding of different refrigeration processes like ice refrigeration, evaporative refrigeration, refrigeration by expansion of air, steam jet refrigeration systems etc.					
CO 2	Identify, formulate and solve air refrigeration, vapour refrigeration and vapour absorption refrigeration problems.					
CO 3	Identify and understand refrigerants and their uses as per their properties and environmental effects etc.					
CO 4	Knowledge of psychometric properties, psychometric chart and its use for different cooling and heating processes along with humidification and dehumidification.					
CO 5	Design of various air-conditioning systems by including the internal and external heat gain.					

**(a) Refrigeration
UNIT I**

Basics of heat pump & refrigerator; Carnot's refrigeration and heat pump; Units of refrigeration; COP of refrigerator and heat pump; Carnot's COP; ICE refrigeration; evaporative refrigeration; refrigeration by expansion of air; refrigeration by throttling of gas; Vapour refrigeration system; steam jet refrigeration; thermoelectric cooling; adiabatic demagnetization.

Basic principles of operation of air refrigeration system, Bell-Coleman air refrigerator; advantages of using air-refrigeration in aircrafts; disadvantages of air refrigeration in comparison to other cold producing methods; simple air refrigeration in air craft; simple evaporative type air refrigeration in aircraft; necessity of cooling the aircraft.

UNIT II

Simple Vapour Compression Refrigeration System; different compression processes(wet compression, dry or dry and saturated compression, superheated compression); Limitations of vapour compression refrigeration system if used on reverse Carnot cycle; representation of theoretical and actual cycle on T-S and P-H charts; effects of operating conditions on the performance of the system; advantages of vapour compression system over air refrigeration system.

Methods of improving COP; flash chamber; flash inter cooler; optimum interstate pressure for two stage refrigeration system; single expansion and multi expansion processes; basic

introduction of single load and multi load systems; Cascade systems.

Basic absorption system; COP and Maximum COP of the absorption system; actual NH_3 absorption system; functions of various components; Li-Br absorption system; selection of refrigerant and absorbent pair in vapour absorption system; Electro refrigerator; Comparison of Compression and Absorption refrigeration systems; nomenclature of refrigerants; desirable properties of refrigerants; cold storage and ice-plants.

(b) Air-conditioning

UNIT III

Difference in refrigeration and air conditioning; Psychometric properties of moist air (wet bulb, dry bulb, dew point temperature, relative and specific humidity of moist air, temperature of adiabatic saturation); empirical relation to calculate P_v in moist air.

Psychometric chart, construction and use, mixing of two air streams; sensible heating and cooling; latent heating and cooling; humidification and dehumidification; cooling with dehumidification; cooling with adiabatic humidification; heating and humidification; by-pass factor of coil; sensible heat factor; ADP of cooling coil; Air washer.

UNIT IV

Classification; factors affecting air conditioning systems; comfort air-conditioning system; winter air conditioning system; summer air-conditioning system; year round air conditioning. unitary air-conditioning system; central air conditioning system; room sensible heat factor; Grand sensible heat factor; effective room sensible heat factor.

Inside design conditions; comfort conditions; components of cooling loads; internal heat gains from (occupancy, lighting, appliances, product and processes); system heat gain (supply air duct, A.C. fan, return air duct); external heat gain (heat gain through building, solar heat gains through outside walls and roofs); solar air temperature; solar heat gain through glass areas; heat gain due to ventilation and infiltration.

Transport air conditioning; evaporative condensers, cooling towers; heat pumps.

Text books

1. Basic Refrigeration and air-conditioning by Annanthana and Rayanan, TMG
2. Refrigeration and air-conditioning by R.C.Arora, PHI

References books

1. Refrigeration and air-conditioning by C.P arora
2. Refrigeration and air-conditioning by Arora and Domkundwar, Dhanpat rai

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. VI th Semester Mechanical Engineering						
ME-304N Tribology & Mechanical Vibration						
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
3	1	0	75	25	100	3
Purpose:	To understand the vibration systems with different degrees of freedom in different modes and conditions and the basics of tribology.					
Course Outcomes						
CO 1	To understand the fundamentals of vibrations and study the systems in single D.O.F. under free and damped vibrations.					
CO 2	To study and analyze the different types of forced vibration system in single D.O.F.					
CO 3	To understand the concept of principle modes of vibrations using different methods and study lateral, longitudinal and torsional vibration in case of beams, bars and shafts respectively.					
CO 4	To understand the fundamentals of tribology of lubrication, friction and wear.					

UNIT I

Fundamentals of Vibration: Elements of a vibratory system, S.H.M., degrees of freedom, Types of vibrations, Work done by a harmonic force, Beats. **Undamped free vibrations:** Natural frequency by equilibrium and energy methods, equivalent spring, linear and torsional systems, compound pendulum, Bifilar and Trifilar suspensions.

Damped free vibrations: Different types of damping, differential equations of damped free vibrations, initial conditions, logarithmic decrement, vibrational energy and logarithmic decrement.

UNIT II

Single Degree of Freedom Systems- Forced Vibrations: Sources of excitation, equations of motion with harmonic force, response of rotating and reciprocating unbalanced system, Support motion, Vibration Isolation, Force and Motion transmissibility.

Forced vibrations with coulomb damping, structural damping and viscous dampings.

UNIT III

Multi-degree of freedom systems: Principle modes of vibrations, Influence co-efficient, Matrix method, orthogonality principle, Dunkerleys equation, Matrix iteration method, Holzer Method, Rayleigh Method and Rayleigh-Ritz methods, Stodola method, Hamilton principle.

Continuous systems: Transverse vibrations of strings, Longitudinal Vibrations of bars, Lateral vibration of beams, Torsional vibration of circular shafts.

UNIT IV

Introduction to Tribology, Tribology in design, Tribology in industry, economic aspects of Tribology, **Lubrication:** Basic modes of lubrication, lubricants, properties of lubricants - physical and chemical, types of additives, extreme pressure lubricants, recycling of used oils and oil conservation, disposal of scrap oil, oil emulsion.

Friction and Wear: Introduction, laws of friction, kinds of friction, causes of friction, friction measurement, theories of friction, effect of surface preparation. Introduction to Wear, Types of wear, various factors affecting wear, measurement of wear, wear between solids and liquids, theories of wear.

Text Books:

1. Grover G. K. “Mechanical Vibrations”, Nem Chand and Bros.,Roorkee
2. Meirovitch, “Elements of Mechanical Vibrations”, McGraw Hill
3. J.S.Rao and K.Gupta, ‘Introductory course on theory and practice of Mechanical Vibration, New Age International.
4. Friction and wear of Materials- By E. Robinowicz, Johan Wiley
5. Tribology an Introduction - By Sushil Kumar Srivastava
6. B. C. Majumdar, “Introduction to Tribology and Bearings“, S.Chand and Company Ltd. New Delhi.

Reference Books:

1. Rao S. S. “Mechanical Vibrations“, Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. New Delhi.
2. V.P. Singh, “Mechanical Vibrations”, Dhanpat Rai & Co. Pvt. Ltd., Delhi
3. Prashant Sahoo, ‘Engineering Tribology’, PHI publications.
4. Halling J., “Principles of Tribology“, McMillan Press Ltd.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. VI th Semester Mechanical Engineering						
ME-306N OPERATION RESEARCH						
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
3	1	-	75	25	100	3
Purpose	To make the students aware of various optimization techniques used for solving engineering problems.					
Course Outcomes						
CO1	To study necessity, applications, scope related to industry. To make the students aware of linear programming and its graphical representation.					
CO 2	To minimize the transportation cost using transportation models. To discuss and understand the network analysis representations.					
CO 3	To understand simulation. Its applications, merits and demerits. Furthermore, waiting line theory and decision theory are also helpful to solve various engineering problems.					
CO 4	Solve the problems related to Queuing theory and game theory.					

UNIT 1

Introduction: Definition and Development of Operations Research, Necessity and scope of OR in Industry, Operations Research in Decision making, Models in OR, Fields of application, Difficulties and Limitation of OR.

General Linear Programming Problems: Introduction, Maximization and minimization of function with or without Constraints, Formulation of a linear programming problem, Graphical method and Simplex method, Big M method, Degeneracy, Application of linear Programming (LPP) in Mechanical Engineering.

UNIT 2

The Transportation Problems: Mathematical formulation, Stepping stone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems and case of degeneracy, Assignment problems, Least time transportation problem

Network Analysis: CPM/PERT, Network Representation, Techniques for drawing network, Numbering of events (Fulkersen Rule), PERT calculations - Forward path, back-ward path, Slack, probability, comparison with PERT, Critical path, Float, Project cost, Crashing the net work, updating (PERT and CPM).

UNIT 3

Simulation: Basic concept of simulation, Applications of simulation, Merits and demerits of simulation, Monte Carlo simulation, Simulation of Inventory system, Simulation of Queuing system.

Waiting Line Theory: Basic queuing process, Basic structure of queuing models, some commonly known queuing situations, Kendall's notation, Solution to M/M/1: ∞ /FCFS models.

Decision Theory: Steps in decision theory approach, Decision Machinery environment, Decision machining under certainty and uncertainty, Decision machining under condition of risk, Decision trees, Minimum enchaind criteria, Advantages and limitations of decision tree solutions, Post Optimality.

Unit 4

Queuing Theory: Introduction, Applications of queuing Theory, Waiting time and idle time costs, Single channel queuing theory and multi-channel queuing theory with Poisson arrivals and exponential services, Numerical on single channel and multi channel queuing theory.

Game Theory: Theory of games, competitive games, Rules and Terminology in game Theory, Rules for game theory- saddle point, dominance, Mixed strategy (2 x2 games) , Mixed strategy (2 x n games or m x 2 games), Mixed strategy (3 x3 games), Two person zero sum games, N-person zero sum games.

Text books

1. Operations Research by Prem Kumar Gupta and D. S. Heera, S. Chand Publications
2. Introduction to Operations Research, by F.S. Hillier and G.J. Lieberman, seventh edition, McGraw Hill publications

Reference Books:

1. Introduction to Mathematical Programming by Winston, W.L. (4th ed.), Duxbury Press.
2. Operations Research by P Sankara Iyer, Mc Graw Hill publications.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

For Mechanical Engg, Electronics Engg and Bio Tech Engg students only

B. Tech. VIth Semester Mechanical Engineering						
CSE-209N	ESSENTIALS OF IT					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time
3	1	-	75	25	100	3 hrs.
Purpose	To introduce the concepts of Object Oriented Programming using Java and RDBMS					
COURSE OUTCOMES						
CO1	Solve Problems using various efficient and reliable Algorithms					
CO2	Design and Study the basic concepts in Java					
CO3	Document and implement Object oriented paradigms and design models in Java					
CO4	Design and study RDBMS Modeling and its program implementation					

UNIT I

Problem Solving Techniques: Introduction to Problem Solving, Introduction to Algorithms and Flowchart, Searching algorithms: Linear search, Binary search and Sorting algorithms: Insertion and Selection sort, Basic Data Structures: Stack, and Linear Queue.

UNIT II

Programming Basics: Identifiers, Variables, Data Types, Operators, Control Structures: Loop, If else, Nested If, Switch Statement, Arrays, Strings, Object Oriented Concepts: Class & Object, Operator, Instance Variables & Methods, Access Specifiers, Reference Variables: This, Super, Parameter Passing Techniques, Constructors, Static, and Command Line Arguments.

UNIT III

Relationships: Inheritance, Types of Inheritance, Static Polymorphism: Method Overloading, Constructor Overloading, Method Overriding, Abstract, Interface, Introduction to Packages.

UNIT IV

RDBMS: Data Processing, Database Technology, Data Models, Data Independence, ER Modeling Concept, ER-notations, Converting ER Diagram into Relational Schema, Definition of Keys: Primary key, Foreign key, Unique Key.

SQL: DDL Statements, DML Statements, DCL Statements, Joins, Sub queries, Views.

Books on Java

1. Java: The Complete Reference, Seventh Edition. Herbert Schildt, McGraw-Hill Education. Programming with Java 3e A Primer, E Balagurusamy, McGraw Hill Education.
2. Introduction to Java Programming, K. Somasundaram, Jaico Publishing House; 1st edition

Books on RDBMS, Oracle, MYSQL

1. Fundamentals of Database Systems, with E-book (3rd Edition) by Shamkant B. Navathe, Ramez Elmasri, Published by Addison Wesley Longman, January 15th, 2002
2. MySQL by Paul DuBois Published by New Riders.
3. Murach's MySQL Paperback, Joel Murach, Published by Shroff/Murach, 2012.
4. SQL: The Complete Reference, James R. Groff, Paul N. Weinberg, Published by McGraw-Hill Companies, March 1999.
5. Schaum's Outline of Fundamentals of Relational Databases, Ramon Mata-Toledo,

Published by McGraw-Hill, 2000.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. VIth Semester Mechanical Engineering						
ME-308N	COMPUTER AIDED DESIGN AND MANUFACTURING					
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
4	0	-	75	25	100	3
Purpose	The subject empowers the students to know about the extreme function of computer in designing, manufacturing as well as in the business scenario.					
Course Outcomes						
CO1	Student gets aware about the introduction of CAD/CAM, and CIM. This unit explains the history and application CAD/CAM.					
CO 2	Student gets aware about the Modeling of different types of curves, surface and solid. The modeling is used for further analysis.					
CO 3	To know about the transformation of points and lines in computer aided software. Group technology is used for utilization machines.					
CO 4	Student knows the usages of the numerical control machines and its code. How computer is useful in making the process planning.					

Unit-I

Introduction to CAD/CAM, Historical Development, Industrial look at CAD/CAM Application of CA/CAM, Display devices, Input/ Output Devices, CPU.

Introduction to CIM, Definition, Nature of Elements of CIM, CIM Wheel,

Introduction to computer aided quality control, Contact and Non Conduct Inspection Method.

Unit-II

Wireframe modeling, Representation of curves, Parametric and non parametric curves, straight lines, Hermite cubic splines, B splines curves.

Plane surface, ruled surface, surface of revolution, bi-cubic surface, Bezier surface, B spline surface, Solid modeling, boundary representation, sweeping, parametric solid modeling.

Unit-III

Introduction, Transformation of points & line, 2-D translation, rotation, Reflection, Scaling, shearing and combined transformation, Homogeneous coordinates, Orthographic and perspective Projections.

Group technology, Part families, Part classification and coding, Optiz method, product flow analysis, Machine cell Design, Advantages of GT

Unit-IV

Numerical control, Types of NC systems, MCU & other components, Co-ordinate system, NC manual part programming, G & M codes, part program for simple parts, Computer assisted part programming.

Introduction, FMS component, Types of FMS, FMS layout, planning for FMS, advantage and applications

Introduction, conventional process planning, Steps in variant process planning, types of CAPP, planning for CAPP

Text books:

1. **Chris McMahon and Jimmie Browne**, CAD/CAM – Principle Practice and Manufacturing Management, Addison Wesley England, Second Edition, 2000.
2. **Rogers, D.F. and Adams, A.**, Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989
3. **Ibrahim Zeid**, CAD/CAM theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
4. **M.P. Groover**, Automation, Productions systems and Computer-Integrated Manufacturing by Prentice – Hall

Reference Books:

1. **Ibrahim Zeid**, Mastering CAD/CAM, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. **P. Radhakrishnan, S. Subramanayan and V.Raju**, CAD/CAM/CIM, New Age International (P) Ltd., New Delhi.
3. **Groover M.P. and Zimmers E. W.**, CAD/CAM: Computer Aided Design and Manufacturing, Prentice Hall International, New Delhi, 1992.
4. **Dr. Sadhu Singh**, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, Second Edition, 2000.
5. **Chang, Wang & Wysk** Computer Aided Manufacturing. Prentice Hall
6. **Kundra & Rao**, Numerical Control and Computer Aided Manufacturing by, Rao and Tiwari, Tata Mc-Graw Hill.
7. **Mattson**, CNC programming Principles and applications, Cengage Learning India Pvt. Ltd. Delhi

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. VI th Semester Mechanical Engineering						
MACHINE DESIGN-II						
Lecture	Tutorial	Practical	Theory	Sessional	Total	Time (Hrs.)
2	0	4	75	25	100	3
Purpose	To deal effectively with engineering problems associated with an individual machine component.					
Course Outcomes						
CO 1	To analyze the force components acting on the gears and solve design problems of different types of gears.					
CO 2	To solve design problems of belts, chains, pulleys and friction clutches and brakes.					
CO 3	To make selection of bearings from manufacturer's catalogue and solve spring design problems.					
CO 4	To design and solve the problems of IC engine components and flywheels.					

UNIT-I

Gear Drives: Classification of gears, selection of type of gears, law of gearing, standard systems of gear tooth, interference and undercutting, backlash, **Spur Gears:** geometry and nomenclature, force analysis, material selection, beam strength of gear tooth, effective load on gear tooth, module estimation based on beam strength, wear strength of gear tooth, module estimation based on wear strength, spur gear design procedure. **Helical Gears:** geometry and nomenclature, force analysis, beam strength of helical gears, effective load on gear tooth, wear strength of helical gears, design procedure. **Bevel Gears:** geometry and nomenclature, force analysis, beam strength of bevel gears, effective load on gear tooth, wear strength of bevel gears, design procedure. **Worm Gears:** terminology, force analysis, friction in worm gears, material selection, strength rating and wear rating, thermal considerations and design procedure.

UNIT-II

Flat Belt Drives and Pulleys: Introduction, Selection of flat belts from manufacturer's catalogue, Pulleys for flat belts. **V-Belts and Pulley:** selection of V-Belts and V-grooved pulley. **Chain Drives:** roller chains, geometric relationships, polygonal effect, power rating, sprocket wheels, design of chain drives, chain lubrication.

Clutches: Various types of clutches in use, design of friction clutches-single disc, multidisc, cone & centrifugal, torque transmitting capacity, friction materials, thermal considerations.

Brakes: Various types of brakes, self-energizing condition of brakes, design of shoe brakes – internal & external expanding, band brakes, thermal considerations in brake designing.

UNIT-III

Springs: Types of springs, design for helical springs against tension and their uses, compression and fluctuating loads, design of leaf springs, surging in springs.

Bearings: Classification, selection of bearing type, static and dynamic load carrying capacity, equivalent bearing load, load-life relationship, selection of bearings from manufacturer's catalogue, selection of taper roller bearing, design for cyclic loads and speeds, bearing failure-causes and analysis. **Sliding Contact Bearings:** design of journal bearings using Raimondi and Boyd's Charts.

UNIT IV

I.C. Engine Components: Design of cylinder, design of studs for cylinder head, design of piston, design of crank shaft, design of connecting rod.

Flywheel: Flywheel materials, torque analysis, coefficient of fluctuation of energy, design of solid disc and rimmed flywheel.

Text books:

1. Mechanical Engineering Design, Joseph E. Shigley and Charles R. Mischke, Tata McGraw Hill Book Co.
2. Design of Machine Element, V. B. Bhandari, Mc Graw Hill Edu. Pvt. Ltd.
3. Machine Component Design, Robert C. Juvinall and Kurt M. Marshek, Wiley India Pvt. Ltd.
4. Mechanical Design of Machine Elements and Machines, Collins and Busby, Wiley India Pvt. Ltd.

References books:

1. Machine Design by Sharma and Aggarwal
2. Machine Design-an integrated Approach, Robert L. Norton, Addison Wisley Longman
3. PSG Design Data Book by PSG college of Engineering, PSG Publication.
4. Design Data Handbook for Mechanical Engineers by K. Mahadevan and K. Balaveera Reddy.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. VIth Semester Mechanical Engineering							
ME-312N Refrigeration and Air Conditioning Lab							
Lecture	Tutorial	Practical	Theory	Sessional	Practical	Total	Time (Hrs.)
-	-	2	-	40	60	100	3
Purpose	To make students understand about the applications of refrigeration and Air-conditioning.						
Course Outcomes:							
CO1	To understand about the basics and working principle of water cooler.						
CO2	Identify the different cycle of operation in air-conditioning						
CO3	To analyze the humidity measurement and its importance in air-conditioning						
CO4	To learn about the various control devices and parts of refrigeration and air-conditioning systems						

List of Experiments

1. To study and perform experiment on basic vapour compression Refrigeration Cycle.
2. To study and perform experiment on Solar Air-conditioner based on vapour absorption cycle.
3. To find COP of water cooler.
4. To study and perform experiments on compound compression and multi-load systems.
5. To study and perform experiment on vapour absorption apparatus.
6. Perform the experiment & calculate various performance parameters on a blower apparatus.
7. To find the performance parameter of cooling tower.
8. To study various components in room air conditioner.
9. To find RH of atmospheric air by using Sling Psychrometer.
10. To find performance of a refrigeration test rig system by using different expansion devices.
11. To study different control devices of a refrigeration system.
12. To find the performance parameters of Ice Plant.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

B. Tech. VIth Semester Mechanical Engineering							
ME-314N TRIBOLOGY & MECHANICAL VIBRATION LAB							
Lecture	Tutorial	Practical	Theory	Sessional	Practical	Total	Time (Hrs.)
-	-	2	-	40	60	100	3
Purpose:	To make the students understand about the tribological properties of specimen and principles of vibration.						
Course outcomes:							
CO 1	To understand the concept of sliding and abrasive wear using wear and friction monitoring apparatus and dry abrasion tester.						
CO 2	To measure the extreme pressure properties of a lubricant using four ball tester.						
CO 3	To study the concept of free and forced vibration for a spring mass system and determine the natural frequency.						

LIST OF EXPERIMENTS:

1. To study undamped free vibrations of equivalent spring mass system and determine the natural frequency.
2. To study the free vibration of system for different damper settings. Draw decay curve and determine the log decrement and damping factor. Find also the natural frequency.
3. To study the torsional vibration of a single rotor shaft system and determine the natural frequency.
4. To determine the radius of gyration of given bar using bifilar suspension.
5. To verify the dunker ley's rule.
6. To study the forced vibration of system with damping. Load magnification factor vs. Frequency and phase angle vs frequency curves. Also determine the damping factor.
7. To determine the two frequencies of torsional spring type double pendulum & compare them with theoretical values.
8. To determine the radius of gyration of a compound pendulum.
9. To determine the radius of gyration of disc using trifilar suspension.
10. To determine the wear rate, friction force and coefficient of friction of a metallic pin/ball by using wear and friction monitor apparatus.
11. To determine abrasion index of a material with the help of dry abrasion test rig.
12. To evaluate the wear and extreme pressure properties of a lubricating oil by using four ball tester.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

B. Tech. VIth Semester Mechanical Engineering							
ME-316N COMPUTER AIDED DESIGN AND MANUFACTURING LAB							
Lecture	Tutorial	Practical	Theory	Sessional	Practical	Total	Time (Hrs.)
-	-	2	-	40	60	100	3
Purpose	The lab empowers the students to know about the computer aided manufacturing by using CAD						
	Course Outcomes						
CO1	Student gets aware about the 2D drawing and modelling.						
CO 2	Student knows how to use 3D software in part designing.						
CO 3	To know about the assembly and aware about the G codes and M codes.						
CO 4	Students will aware about the NC part programming and OPTIMIZE method.						

List of experiments

- 1 To study the 2 dimensional drawing, orthographic views, front view, top view and side view.
- 2 To study the wireframe, surface and solid modelling.
- 3 Draw the part drawing of product 1 using any 3D software.
- 4 Draw the part drawing of product 2 using any 3D software.
- 5 Make assembly by using any 3D software.
- 6 To study the G codes and M codes.
- 7 Write a NC program for milling operation.
- 8 Write a NC program for drilling operation.
- 9 Write a NC program for turning operation.
- 10 To study the optimize method.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory. Product 1 and Product 2 must be based on ME 308N.