B.Tech. (Fifth semester) Mechanical engineering

ME 301 E I.C.ENGINE AND GAS TURBINES

L	T	P/D	Total
3	1	-	4

Theory: 100 Marks
Sessional: 50 marks
Duration of Exam: 03 hours

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.

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;

UNIT IV

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.

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.

Recommended books

- Internal combustion engine by Ramalingam scitech publication
- Internal combustion engine by Ganeshan TMG
- Internal combustion engine by Mathur & Sharma
- 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 two question from each unit, and students will be required to attempt only 5 questions, at least one from each unit.

B. Tech. (Fifth semester) Mechanical engineering

ME 303 E FLUID MACHINES

L	T	P/D	Total
3	1	-	4

Theory: 100 Marks
Sessional: 50 marks
Duration of Exam: 03 hours

UNIT I

Impact of jet stationary and moving flat and curved plates, Force on series of vanes, Radial vanes, Vortex motion, Free and forced vortex , jet propulsion of ships
Units and dimensions; Dimensional homogeneity; Dimensional analysis' methods; Ray Leigh and Buckingham methods, Applications and limitations of dimensional analysis Dimensionless numbers, Similitude laws.

UNIT II

Introduction; Development of hydraulic turbines; Components of hydropower plant; Classification of turbines; Surge tank and its type.
Pelton turbine, Its components, Number and dimension of buckets, Speed ratio, Jet ratio, Energy conversion, Condition for maximum efficiency; Design considerations. Governing etc.
Francis turbine, its components, working principles. Draft tube, Types of draft tube, Design considerations; Outward vs. Inward flow reaction turbines, Introduction to Deriaz turbine, Evolution of axial flow turbines, Kaplan turbine, Operation at off-design loads, Governing etc.
Unit quantities, Specific speed, Runway speed, Characteristics of turbines.

UNIT III

Introduction, Classification, Components, Principle of working, various heads, Energy conversion, Euler's head and its variation with vane shapes. Effect of finite number of vanes, Losses and efficiencies, Minimum starting speed, Limitation of suction lift, Net Positive Suction Head (NPSH); Multistage pumps, Specific speed and performance.
Working principles, Classification, Components, Discharge, Discharge slip, Power input, Indicator diagram, Effect of friction, Acceleration and pipe friction, Maximum speed, Air vessels,
Comparison with centrifugal pumps. Model testing of pumps.

UNIT IV

Cavitations and its effects, Cavitation parameters, Detection and Prevention of cavitations. Model testing of turbine
Propeller pump, Jet pump, Airlift pump, Gear pump, Screw pump, Vane pump, Radial piston pump, Submersible pump, Pump problems
Hydraulic accumulators, Hydraulic intensifier, Hydraulic lift, Hydraulic crane. Hydraulic coupling, Torque converter, Hydraulic ram.

Recommended books

- Fluid mechanics and machinery by S.K.Aggarwal TMG
- Fluid mechanics & fluid power engineering by D.S kumar, Katson publisher
- Fluid mechanics and Hydraulic machine by S.S rattan, Khanna publisher
- Introduction to fluid mechanics and machinery by Som and Bishwas, TMH

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

B.Tech. (Fifth semester) Mechanical engineering

ME 305 E **HEAT - TRANSFER**

L	T	P/D	Total
3	1	-	4

Theory: 100 Marks
Sessional: 50 marks
Duration of Exam: 03 hours

UNIT I

Definition of heat; Modes of Heat Transfer; Basic Laws of heat transfer, Electrical Analogy of heat conduction; Conduction through composite Walls; Overall heat transfer coefficient.
The general conduction equation in Cartesian, cylindrical and spherical coordinates Steady one dimensional heat conduction without internal heat generation; The plane slab; 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; Fins of uniform cross section; Governing equation; Temperature distribution and heat dissipation rate; Efficiency and effectiveness of fins.

UNIT II

Free and forced convection; Newton's law of cooling, Convective heat transfer Coefficient; Nusselt number; Dimensional analysis of free and forced convection; Analytical solution to forced convection problems; The concept of boundary layer; Hydrodynamic and thermal boundary layer; Momentum and Energy equations for boundary layer; Exact solution for laminar flow over an isothermal plate using similarity transformation; The integral approach; Integral momentum and energy equations; Solution of forced convection over a flat plate using the integral method. Analysis of free convection; governing equations for velocity and temperature fields. Relation between fluid friction and heat transfer, Reynolds analogy Dimensionless numbers; Reynolds, Prandtl Nusselt , Grashoff and Stanton Numbers and their significance, Heat transfer with change of phase; Nusselt theory of laminar film Condensation.

UNIT III

Theories of thermal radiation; Absorption, Reflection and transmission, Monochromatic and total emissive power; Black body concept; Planck's distribution law; Stefan Boltzman law; Wien's displacement law; Lambert's cosine law; Kirchoff's law; Shape factor; Heat transfer between black surfaces.

UNIT IV

Introduction; Classification of heat exchangers; Logarithmic mean temperature Difference; Area calculation for parallel and counterflow heat exchangers; Effectiveness of heat exchangers; N T U method of heat exchanger design; Applications of heat exchangers.

Reference and Text books:

- A Text book of Heat Transfer by S.P Sukhatme, university press
- Heat transfer by Holman, TMG
- Heat and Mass transfer by D.S Kumar

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

B.Tech. (Fifth semester) Mechanical engineering

ME 307 E INDUSTRIAL ENGINEERING

L	T	P/D	Total
3	1	-	4

Theory: 100 Marks
Sessional: 50 marks
Duration of Exam: 03 hours

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; technique; (time) information recording; methods of timings; Time study allowances; Work sampling technique; Performance rating and its determination PMTS; M. T. M.; Work factor.

UNIT II

Principles 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, Committees.

Objectives of PPC; Functions of PPC; Preplanning and planning; Routing; Estimating; scheduling-master schedule; Daily schedule; Gantt chart; Dispatching –centralized vs. decentralized; Control; Follow up and progress reporting.

Introduction; Product development; Product characteristics; Role of product development; 3Ss – Standardization; Simplification and Specialization.

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, Moving average method, Time series analysis.

Introduction, Functions of inventory; Types of inventory; Control importance and functions, Inventory costs, Factors affecting inventory control, Various inventory control models. A. B. C. analysis, Lead-time calculations.

UNIT IV

Introduction; Objectives; Concept and life cycle of a product and V.E.; Steps in VE., Methodology and techniques, Fast diagram, Matrix method.

Various concepts in industrial engineering

a) WAGES AND INCENTIVES; -Concept; Types; Plans; Desirable characteristics.
b) ERGONOMICS; - its importance; Man-machine work place system; Human factors considerations in system design.
c) SUPPLY CHAIN MANAGEMENT; - its definition, Concept, Objectives, Applications, benefits, Some successful cases in Indian Industries.
d) JIT; - Its definition, Concept, Importance, Misconception, Relevance, Applications, Elements of JIT (brief description).
e) MRP;-Introduction, Objectives, factors, Guide lines, Techniques Elements of MRP system, Mechanics of MRP, MRP-II
f) TIME MANAGEMENT;-Introduction, Steps of time management, Ways for saving time, Key for time saves.

Reference and Text books:

- Production planning and control by S.Elion
- Modren production Management by S.S Buffa
- Industrial engg. and management manufacturing system by Surender kumar, Satya prakashan
- Essence of Supply Chain Management by R.P mohanty and S.G Deshmukh
- Industrial engg. and management by S Sharma and Savita sharama

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

B.Tech. (Fifth semester) Mechanical engineering

ME 309 E Machine Design- 1

L	T	P/D	Total
2	-	5	7

Theory: 100 Marks
Sessional: 50 marks
Duration of Exam: 03 hours

UNIT I

Properties: Chemical, Physical, Mechanical and Dimensional; Ferrous metals, Non-ferrous metals, Plastics, Composite materials etc.; Selection of Engineering Materials.
Design methodology; Design criterion based on fracture; Deformation and elastic stability design stresses; Factor of safety; Significant stress and significant strength; Stresses-concentration; Causes and mitigation; Endurance limit; Effect of concentration; Notch sensitivity; Size and surface finish; Goodman diagram; Gerber's parabola and Soderberg line.

UNIT II

Supports and retainment of rotating assemblies; manufacturing considerations of design, design of castings and weldments.
Riveted joints for boiler shell according to I. B. R.; riveted structural joint; and riveted joint with eccentric loading; Types of welded joints; strength of welds under axial load; Welds under eccentric loading; Designation of various types of bolts and nuts, Design of bolted joints, Bolts of uniform strength, Bolted joints with eccentric loads, Design of Keys, Cotter joint and knuckle joints.

UNIT III

Design of shafts subjected to pure torsion; Pure bending load; Combined bending and torsion; Combined torsion; Bending and axial loads.
Introduction, hand and foot levers, cranked lever, lever for a lever safety valve, Bell crank lever. Miscellaneous levers.

UNIT IV

Types of shaft couplings, Design of sleeve or muff coupling; Flange coupling and bush type flexible couplings.
Introduction, Design of circular, oval shaped and square flanged pipe joints.
Function, types of power screws, stresses in screws, design calculations.

References and text books:

- Design of machine element By Bhandari
- Machine design by Malvee and Hartmann, CBS publication
- Machine design by Sharma and Aggarwal
- PSG Design Data Book PSG College of Engg PSG Publication
- Machine Design an integrated Approch Robert l Norton, prentice hall
- Fundamental of machine component design R.C Juvinnal, Johan wiley& sons

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

B.Tech. (Fifth semester) Mechanical engineering
ME 311 E STEAM GENERATION & POWER

L	T	P/D	Total
3	1	-	4

Theory: 100 Marks
Sessional: 25 marks
Duration of Exam: 03 hours

UNIT I

Introduction; classification of boilers; comparison of fire tube and water tube boiler; their advantages; description of boiler; Lancashire; locomotive; Babcock; Wilcox etc.; boiler mountings; stop valve; safety valve; blow off valve; feed check etc.; water level indicator; fusible plug; pressure gauge; boiler accessories; feed pump; feed water heater; preheater; superheater; economizer; natural draught chimney design; artificial draught; stream jet draught; mechanical draught; calculation of boiler efficiency and equivalent evaporation(no numerical problem)

UNIT II

Carnot cycle; simple and modified Rankine cycle; effect of operating parameters on rankine cycle performance; effect of superheating; effect of maximum pressure; effect of exhaust pressure; reheating and regenerative Rankine cycle; types of feed water heater; reheat factor; binary vapour cycle.

Simple steam engine, compound engine; function of various components.

UNIT III

Function of steam nozzle; shape of nozzle for subsonics and supersonics flow of stream; variation of velocity; area of specific volume; steady state energy equation; continuity equation; nozzle efficiency; critical pressure ratio for maximum discharge; physical explanation of critical pressure; super saturated flow of steam; design of steam nozzle.

Advantage of steam condensation; component of steam condensing plant; types of condensers; air leakage in condensers; Dalton's law of partial pressure; vacuum efficiency; calculation of cooling water requirement; air expansion pump.

UNIT IV

Introduction; classification of steam turbine; impulse turbine; working principal; compounding of impulse turbine; velocity diagram; calculation of power output and efficiency; maximum efficiency of a single stage impulse turbine; design of impulse turbine blade section; impulse reaction turbine; working principle; degree of reaction; parsons turbine; velocity diagram; calculation of power output; efficiency of blade height; condition of maximum efficiency; internal losses in steam turbine; governing of steam turbine.

Text Books :

1. Thermal Engineering – P L Ballaney, Khanna Publishers
2. Thermodynamics and Heat Engines vol II – R Yadav, Central Publishing House

Reference Books :

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A McConkey, Pearson Education
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd

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

B.Tech. (Fifth semester) Mechanical engineering

ME 313 E **Thermal Engineering (Practical)**

L	T	P/D	Total
-	-	2	2

Theory: 25 Marks
Sessional: 25 marks
Duration of Exam: 03 hours

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 (1) the Fuel Injection System of a C. I. Engine.
    a. (11) 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: **Total Ten experiments must be performed**. **At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.**

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ME 315 E Fluid Machines (Practical)

L	T	P/D	Total
-	-	2	2

Theory: 25 Marks
Sessional: 25 marks
Duration of Exam: 03 hours

List of Experiments

1. To study and perform lest 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 ηVs 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& Np.

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ME 317 E Heat Transfer (Practical)

L	T	P/D	Total
-	-	2	2

Theory: 25 Marks
Sessional: 25 marks
Duration of Exam: 03 hours

List of Experiments

1. Determination of thermal conductivity of a metal rod
2. Determination of thermal conductivity of an insulating powder
3. Determination of thermal conductivity of a liquid using Guard plate method
4. Determination of thermal resistance of a composite wall
5. Temperature distribution of a pin fin in free-convection
6. Temperature distribution of a pin fin in forced-convection
7. Forced convection heat transfer from a cylindrical surface
8. Determination of Electiveness of a Heat exchanger
9. Determination of Stefan-Boltzman constant
10. Performance of Solar still
11. Determination of critical heat flux
12. Performance of solar water heater
13. Measurement of solar radiation using solar integrator.

Note: **Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.**

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ME 319 E Industrial Engineering (Practical)

L	T	P/D	Total
-	-	2	2

Theory: 25 Marks
Sessional: 25 marks
Duration of Exam: 03 hours

List of Experiments

1. To study various Rating Factor systems and find standard time for making small sand mould.
2. To study various plat layouts and suggest improvements in existing Machines Shop layout.
3. To study and draw organizational structure of a near by industry and suggest changes.
4. To draw X and R charts for a given sample of products to check their acceptance.
5. To draw p chart for a given product lot and verify its acceptance
6. Draw a flow process chart with time estimates for a simple welding process.
7. Draw a two handed process chart for a simple process of a job preparation on a lathe.
8. To study various purchase procedures and draw organizational structure of college purchase department.
9. A case study on ABC/VED analysis.
10. A case study on Quality Improvement Techniques (e.g. Hostel Mess/ Workshop / Canteen etc.)
11. A market survey and analysis.
12. A “preliminary project report” preparation for any small-scale unit.

Note: **Total Ten experiments must be performed. At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or outside the list.**