

Mechanical Engineering Paper-1 Syllabus :

This part is for both objective and conventional type papers:

1) Thermodynamics-

Thermodynamics is a branch of science which is concerned with the relations between heat and other forms of energy involved in chemical and physical processes. It include

- Thermodynamics, Basic concepts, Open and Closed systems, Cycles and IC Engines.
- Application to non-Flow and Flow processes, Zeroth, First and Second Law.
- Availability, Tds and Irreversibility relations, Entropy.
- Heat and work.
- Properties of ideal gases and vapours ,Claperyron and real gas equations.
- Gas power and Refrigeration cycles, Standard vapour.
- C-I and S.I. Engines.
- Two stage compressor.
- Pre-ignition, Fuel injection and Carburation, Detonation and Diesel-knock, Supercharging.
- Emission & Control ,Flue gas analysis, Measurement of Calorific values, Engine Cooling, Turbo-prop and Rocket engines.
- Elements of Nuclear power production , Conventional and Nuclear fuels.

2) Heat Transfer and Refrigeration and Air conditioning -

An air conditioning system's efficiency depends on how well it moves heat. Heat always travels from warm material to cold material and the reverse is never true. This part includes

- Heat Transfer and Air conditioning and Refrigeration .
- One dimensional steady and unsteady conduction.
- Modes of heat transfer.
- Equivalent Resistance and Composite slab .
- Heat dissipation from extended surfaces, Overall heat transfer coefficient, Heat exchangers, Thermal boundary layer over a flat plate ,Empirical correlations for heat transfer in laminar and turbulent flows and for free and forced Convection.
- Shape factor, Fundamentals of diffusive and connective mass transfer, Enclosure theory, Black body and basic concepts in Radiation, Network analysis.
- Refrigerants, Heat pump and Refrigeration cycles and systems.

- Condensers, Psychrometry, Charts and application to air conditioning, Evaporates and Expansion devices, Sensible heating and cooling, comfort indices, Load calculations, Solar refrigeration, Effective temperature, controls, Duct design.

3) Fluid Mechanics-

Majority of the mechanical processing operations are carried out either partially or completely in fluid system so for mechanical engineers it is important to have a knowledge about fluid mechanism. Handling fluid is considered to be cheaper and less troublesome when compared with solids. This section includes

- Properties and classification of fluids, Manometry, Center of pressure, Elements of stability of floating bodies, forces on immersed surfaces, Buoyancy.
- Irrotational and incompressible.
- Kinematics and Dynamics.
- Inviscid flow.
- Pressure field and Forces on immersed bodies ,Velocity potential.
- Bernoulli's equation, Pressure drop calculations, Fully developed flow through pipes, Measurement of flow rate and Pressure drop.
- Integral approach, Separations, Elements of boundary layer theory , Laminar and turbulent flows.
- Flow over weirs and notches.
- Hydraulic jump ,Open channel flow.
- Dimensional analysis, Dimensionless numbers and Similitude and modelling .
- Flow through convergent – divergent ducts, One-dimensional isentropic flow, Normal shock wave, Rayleigh and Fanno lines ,Oblique shock-wave.

4) Fluid Machinery and Steam Generators –

This part most often deals with the problem related with fluid behavior so understanding the behavior of the fluid is an essential aspect. So this part mainly includes

- Performance, Classification , Specific speed, Operation and control of hydraulic Pump and impulse and reaction Turbines.
- Energy transfer, Power transmission, Coupling, Steam generators Fire-tube and water-tube boilers.
- Wetness and condensation ,Flow of steam through Nozzles and Diffusers.
- Partial admission.

- Velocity diagrams ,Various types of steam and gas Turbines.
- Reciprocating, Multistage compression, role of Mach Number, Efficiency, Centrifugal and axial flow Compressors, Reheat, Regeneration, Governance.

Mechanical Engineering Paper-2 Syllabus:

This part is for both objective and conventional type papers :

5) THEORY OF MACHINES-

Theory of Machines is also known to be an applied science. It takes care of strength and motion aspect of a machine and uses principles from kinematics, physics, kinetics and static . Machines are known to be mechanical devices used to carry out work.Mechanism is a system of rigid elements and mainly consists of linkages and joints. It includes

- Kinematic and dynamic analysis of planer mechanisms.
- Gears and gear trains.
- Cams.
- Governors.
- Flywheels.
- Multicylinder engines and Balancing of single ,Linear vibration analysis of mechanical systems .
- Field balancing and Balancing of rigid rotors .
- Whirling of shafts Automatic controls and Critical speeds .

6) MACHINE DESIGN-

Design Machine design deals with modeling , integration ,design and best usage of machine elements like springs ,cams, gears, bearings and mechanisms. These things are based on extensive application of mathematics ,physics and core principles of mechanical engineering. This includes

- Design of Joints : cotters, splines, keys, threaded fasteners, welded joints, joints formed by interference fits.
- Design of friction drives : couplings and clutches, power screws, belt and chain drives.
- Design of Power transmission systems : wire ropes ,gears and gear drives shaft and axle.
- Design of bearings : rolling element bearings and hydrodynamics bearings .

7) STRENGTH OF MATERIALS-

Strength of materials is also known as Mechanics of materials. Its subject which deals with the actions of objects with standing strains and stresses. On the basis of mathematical modeling in first and second principal stress this theory was established. This includes

- Stress and strain in two dimensions, Mohr's construction, linear elastic materials, isotropy and anisotropy, thermal stresses, stress-strain relations, Principal stresses and strains, uniaxial loading.
- Beams : Bending moment and shear force diagram, bending stresses and deflection of beams.
- Helical springs, Torsion of shafts.
- Shear stress distribution.
- Theories of failure and Strain energy concepts.
- Struts and columns.
- Thick-and thin-walled pressure vessels, Combined stresses.

8) ENGINEERING MATERIALS-

Mechanical engineers design and develop devices which facilitate humans to live and work in space, on the ground, in the air and under water. These developed machines can widen the physical capabilities, standard of living and improve our health, and affects the environment in which we live. This section includes

- Basic concepts on structure of solids.
- Crystalline materials.
- Alloys and binary phase diagrams.
- Structure and properties of common engineering materials.
- Plastics, Ceramics and composite materials.
- Common applications of various materials.
- Defects in crystalline materials.
- Heat treatment of steels.

9) PRODUCTION ENGINEERING-

Production of Engineering deals with analytical skills and creative ideas which is the basis of construction and development of machines, engines and a multitude of other structures. This includes

- Metal Forming : Basic Principles of forging, drawing and extrusion; Powder metallurgy; High energy rate forming.

- Metal Casting : Die casting, investment casting, Centrifugal Casting, Shell Moulding, Gating & Riser design; melting furnaces.
- Fabrication Processes : Principles of Gas, Shielded arc Welding ,Arc; Advanced Welding Processes, Weldability: Metallurgy of Welding.
- Metal Cutting : Turning, Drilling, Boring, Milling, Methods of Screw Production ,Gear Manufacturing, Grinding & Finishing Processes, Production of flat surfaces.
- Automation and Robotics ,Computer Controlled Manufacturing Systems-CNC, DNC, FMS.
- Cutting Tools Materials, Mechanism of Tool Wear, Tool Geometry, Tool Life & Machinability; Measurement of cutting forces.
- Economics of Machining.
- Jigs and Fixtures.
- Unconventional Machining Processes.
- Measurement of surface texture ,Fits and tolerances, Comparators Alignment tests and reconditioning of Machine Tools.

10) INDUSTRIAL ENGINEERING-

Industrial engineering is a branch of engineering which deals with the optimization of complex systems. It is concerned with the improvement, development , evaluation and implementation of integrated systems of people ,knowledge, money, information, energy, equipment, analysis materials, along with the mathematical, social and physical sciences .This segment includes

- Production Planning and Control : Forecasting – Moving average, Operations, scheduling; assembly line balancing, Break-even analysis, exponential smoothing, Product development, Capacity planning, PERT and CPM.
- Control Operations : Inventory control ABC analysis, Materials requirement planning, EOQ model.
- Job design, Job standards, Work measurement, Quality Management – Quality analysis and control.
- Operations Research : Transportation and assignment models ,Linear Programming – Graphical and Simplex methods.
- Value Engineering : Value analysis for cost/value.
- Single server queueing model.

11) ELEMENTS OF COMPUTATION-

Elements of computation is used for computer organization to perform certain computation work .This segment includes

- Computer Organisation, Features of Common computer Languages – FORTRAN, Flow charting, d Base III, Lotus 1-2-3, C and elementary Programming.

