

SYLLABUS FOR MANAGEMENT TRAINEE - MECHANICAL

PART I- GENERAL MANAGEMENT APTITUDE

1. Mental Ability & Reasoning (Intelligence & Critical Reasoning)

- Logical Reasoning: Syllogisms, statement & conclusions, statement & arguments, course of action, decision making.
- Analytical Reasoning: Puzzles, seating arrangements, complex arrangements, linear and circular arrangements.
- Verbal Reasoning: Series completion (alphanumeric, number, symbol), analogies, classification (odd one out), coding-decoding, blood relations, direction sense test.
- Non-Verbal Reasoning: Visual reasoning, paper folding/cutting, mirror images.

2. English Language & Comprehension (Language Comprehension)

- Reading Comprehension: Understanding and interpreting passages.
- Grammar: Rules for tenses, prepositions, articles, subject-verb agreement, active and passive voice, direct and indirect speech, spotting errors.
- Vocabulary: Synonyms, antonyms, idioms & phrases, one-word substitutions, words often confused and misused.
- Verbal Ability: Sentence correction, sentence completion/fill in the blanks, para jumbles/sentence rearrangement.

3. Data Analysis & Interpretation (Data Analysis & Sufficiency)

- Data Interpretation (DI): Analysis of data from sources such as bar graphs, line graphs, pie charts and tables.
- Data Sufficiency & basic Statistics
- Numerical Ability (Mathematical Skills/Quantitative Aptitude)
- Arithmetic:
- Number systems, HCF and LCM.
- Percentages, profit & loss, simple & compound interest.
- Ratio & proportion, averages, problems on ages.
- Time & work, time & distance, pipes & cisterns.
- Mixtures and allegations, partnership.
- Algebra: Basic algebra, linear equations, inequalities, logarithms, permutations and combinations (occasionally).
- Geometry & Mensuration: Basic geometry (triangles, circles) and mensuration (area and volume).
- Simplification: Square roots, cube roots, surds & indices

DISCIPLINE – MECHANICAL

1. **Engineering Mechanics:** Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions.
2. **Mechanics of Materials:** Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.
3. **Theory of Machines:** Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.
4. **Vibrations:** Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.
5. **Machine Design:** Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.
6. **Fluid Mechanics:** Fluid properties; fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.
7. **Heat-Transfer:** Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.
8. **Thermodynamics:** Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.
9. **Applications:** Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles. Refrigeration and air-conditioning: Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes.

Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

10. **Engineering Materials:** Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.
11. **Casting, Forming and Joining Processes:** Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.
12. **Machining and Machine Tool Operations:** Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, design of jigs and fixtures.
13. **Metrology and Inspection:** Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.
14. **Computer Integrated Manufacturing:** Basic concepts of CAD/CAM and their integration tools.
15. **Production Planning and Control:** Forecasting models, aggregate production planning, scheduling, materials requirement planning.
16. **Inventory Control:** Deterministic models; safety stock inventory control systems.
17. **Operations Research:** Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.
