

INDIAN INSTITUTE OF TECHNOLOGY MADRAS, CHENNAI-600036.

Advertisement No. IITM/R/4/2024 dated 11.03.2024

Syllabus & Scheme of Examination

Post: Junior Technical Superintendent

Stream: Mechanical Engineering

LEVEL-1 Multiple Choice Question Test

(100 Marks)

PART – A

(30 Marks)

- **Quantitative aptitude:** Number systems, simplification, decimals, fractions, LCM, HCF, ratio & proportion, percentage, log and trigonometric functions, solutions of simple equations (linear and quadratic), basic statistics – mean and standard deviation, profit & loss, discount, simple & compound interest, mensuration, time & work, time & distance, tables & graphs.
- **Logical reasoning aptitude:** Analogies, similarities, differences, space visualization, analysis, judgment, decision making, visual memory, discrimination, observation, relationship concepts, arithmetical reasoning, verbal and figure classification
- **Computer-related aptitude:** Hardware, software, operating systems, basic operations in MS Office - Word, Excel, PowerPoint
- **Language aptitude:** Comprehension, vocabulary, basic grammar in English.
- **General awareness aptitude:** Current events, general knowledge, Indian history, Indian constitution, basic geography.

PART – B

(70 Marks)

1. **Materials and Manufacturing:** Materials: Different types and fundamentals of metals, alloys, polymers, ceramics, and composites; Mechanical properties; heat treatment of steels, applications. Engineering drawing: Projection of point, line, plane and solid, isometric projection, Fitting and carpentry workshop practices on metal casting, forming, sheet metal working, machining -turning, milling, drilling, grinding, tapping; joining techniques, understanding of machine tools like conventional lathe, milling, drilling, grinding; tooling, press tool operations, jigs and fixtures, CNC machines-basic features, and part programming; micro fabrication, dimensional characteristics, limits-fits-tolerances, linear, and angular measurement tools, comparators, measurement of surface roughness, straightness, flatness, roundness, cylindricity, screw thread measurement, gear measurement.
2. **Engineering mechanics, strength of materials and design:** Engineering mechanics - centroids, centre of gravity, moment of inertia, friction, statics and dynamics, work, power, energy. Strength of materials - stress, strain, bending moment, shear force diagram, deflection of beam. Design- degree of freedom, simple mechanisms- 2 bar/4 bar mechanisms-quick return mechanisms, Geneva mechanism, cam and followers, gear tooth profiles; design of shaft, key, couplings, spur gears; basics of vibrations - free and forced vibration with single degree of freedom model.
3. **Measurements:** Measurement of different mechanical quantities and working principles- Temperature, viscosity, thermal conductivity, convective heat transfer coefficient, flow, Strain, Acoustics, Humidity measurement, Force; Shaft Power.

4. Electrical, electronics, instrumentation, and control: DC circuits, AC fundamental and single/poly phase AC circuits, DC/AC motors, alternators, DC/AC related measuring instruments and working principles, transformer, simple electrical circuits. diodes and transistors, thermistor-NTC, PTC; Circuit diagrams and operations, power amplifier, oscillator, OP Amp, Analog to Digital Converters, Digital to Analog converter, actuator, PLC and simple PLC programming; Control systems-Block diagram of automatic control system, open and closed loop systems, servomotor mechanism: basics of hydraulic, pneumatic, electronic control systems.

5. Heat Power Engineering

Basics of thermodynamics: Definitions and units of mass, weight, volume, density, specific weight, specific gravity and specific volume, pressure, units of pressure, temperature, absolute temperature, heat, specific heat capacities, work, power, energy; zeroth, first and second laws of thermodynamics.

Thermodynamic air cycles and fuels and combustion: Air cycles: air standard efficiency, reversible and irreversible processes, assumptions in deriving air standard efficiency, Carnot cycle, Otto cycle, Diesel cycle, comparison of ideal and actual p-v diagrams of Otto and Diesel cycles.

6. Fluid Mechanics and Fluid Power

Properties of fluids and pressure measurements: Definition of fluid, ideal and real fluids, properties of a fluid, definition and units; pressure, units of pressure, pressure head, atmospheric, gauge and absolute pressure, Pascal's law and applications - hydraulic press and jack; pressure measurement, U-tube manometer, differential U-tube manometer, inclined tube manometer, mechanical gauges - Bourdon's gauge, diaphragm pressure gauge, dead weight pressure gauge. Flow of fluids and flow through pipes, Hydraulic turbines, centrifugal and reciprocating pumps.

7. Thermal And Automobile Engineering

Thermal power plant, steam turbines and condensers, refrigeration, and air conditioning: Layout of thermal power plant, merits and demerits of thermal power plant, pollutants, effects and control, cyclone separator, wet scrubber, electrostatic precipitator, control of NO₂ and SO₂. Basic steam power cycles – Carnot, Rankine cycles, classification of steam turbine - impulse and reaction turbines, difference. Refrigeration – Definition, COP, unit of refrigeration, vapour compression system, absorption system, refrigerants. Air-conditioning - definition, centralised air conditioning.

IC engines and their components: combustion engines, classification, four stroke and two stroke, petrol and diesel engines, comparison. Basic engine components - functions, types, materials and construction of cylinder block, crankcase, cylinder head, liners, piston, piston rings, piston pin, connecting rod, crankshaft, flywheel, cam shaft, valves and valve mechanisms.

Automobile transmission and power trains and chassis: Transmission and Power Trains: general arrangement of power transmission system, front engine rear drive, rear engine rear drive, front engine front drive, four-wheel drive, applications, clutch – single plate, multi plate and diaphragm spring clutch, fluid coupling. Gear box – purpose, types of gear boxes – sliding mesh, constant mesh and synchromesh, drive line – propeller shaft, universal joint, final drive, types of gear arrangement. Differential – purpose, construction and operation, self-locking and non-slip differential.

LEVEL – 2 Trade Test

- **Trade Test** - Syllabus as above under Part-B for Level-1 Multiple Choice Question Test

Scheme of Examination:

Level	Type of Test	Time	Details	Weightage for the final result
Level -1	Multiple Choice Question Test	Time: 120 Minutes	100 Objective Questions – 100 Marks	70 %
Level-2	Trade Test	Time: 90 minutes approximately	Practical Trade Test	30 %

- A minimum of 5X candidates shall be shortlisted (for X number of posts advertised) for the Level-2 Trade Test, based on their performance in the Level-1 Multiple Choice Question Test.

NOTE:

- a) The medium of examination will be ENGLISH
 - b) The questions will generally be on the minimum qualification level i.e. Diploma Level.
 - c) There shall be no negative marking for wrong answers.
 - d) **The Level-1 Multiple Choice Question Test is tentatively scheduled to be held on 07th February 2025 at TCS iON Centres in Chennai.**
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