**INDIAN INSTITUTE OF TECHNOLOGY MADRAS, CHENNAI-600036.**

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

**Syllabus & Scheme of Examination**

**Post: Technical Officer** **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 $NO_2$ and $SO_2$. 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 Professional Competence Test

- **The Professional Competence Test will be a Descriptive Test and/or Laboratory based Test** for testing Professional Competence on the topics mentioned under Part-B for Level-1Test.

## LEVEL – 3 Personal Interview

- Syllabus as mentioned for Professional Competence Test.
- The Interview/personality test shall be conducted in such a manner that the candidate's suitability for the post is tested, among other things, through academic qualifications, experience, general awareness/knowledge, communication and problem-solving skills, and overall personality, etc.

## Scheme of Examination:

| Level | Type of Test | Time | No. of Questions – Max. Marks | Weightage for the final result |
|---|---|---|---|---|
| Level -1 | Multiple Choice Question Test | Time: 120 Minutes | 100 Objective Questions – 100 Marks | 40 % |
| Level–2 | Professional Competence Test | Time: 90 minutes approximately | Descriptive / Practical Test | 30 % |
| Level-3 | Personal Interview | | 40 Marks | 30% |

- A minimum of 7X candidates shall be shortlisted (for X number of posts advertised) for the Level-2 Professional Competence Test based on their performance in the Level-1 Multiple Choice Question Test.
- A minimum of 3X candidates shall be called for Personal Interviews based on their performance in Level-1 and Level-2 Tests.

**NOTE:**

a) The medium of examination will be ENGLISH
b) The questions will generally be on the minimum qualification 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.**