## Syllabus for the post of JUNIOR TECHNICAL ASSISTANT (Mechanical Engineering)

### WRITTEN TEST & SKILL TEST (Manufacturing Labs)

1. **Foundry Shop:** Understanding of basic steps in casting operation, terminology, process flow; mould making process and tools; sand testing equipment; working and operation of equipment using in casting shop; Safety precautions for foundry
2. **Machine Shop:** Standard machine tools and their operations; Cutting tools for various machines, cutting tool materials, tool geometry; Cutting fluids, classification; Grinding machine types and operations, types of grinding wheels, specifications; Safety precautions for machine shop
3. **Assembly Shop:** Processes in fitting shop; Equipment; Layout procedure; File work; Thread cutting tools; Operation and types of chisels, scrapers, dividers, calipers
4. **Welding Shop:** Welding processes and equipment; operations of welding machines; selection of consumables such as electrode, flux, nozzles, gas etc.; types of welds, joints and positions; Safety precautions for welding
5. **Smithy, Forging and Sheet Metal Work:** Knowledge of equipment and tools for smithy, forging and sheet metal work; Operations related to Smithy, forging and sheet metal work; Knowledge of control parameters to achieve defect-free parts; Safety precautions
6. **Metrology:** Understanding related to operation and working principles of measuring equipment and tools used for inspection on shop floor; Knowledge of standards of measurement; Measurement of Surface roughness
7. **Advanced Manufacturing:** Understanding related to operation and working principles of advanced manufacturing and inspection equipment such as CNC Machines, 3-D Printers and Coordinate Measuring Machine; Knowledge of computational tools for component fabrication; Knowledge of Programming for component fabrication; Reverse Engineering of components on CMM
8. **General Skills:** Planning & performing simple repair, overhauling of different machines and checking functionality, skills to execute pipe joints, dismantling and assembling valves and fittings. Testing for leakages, planning and performing basic day to day preventive maintenance, and safety aspects.

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### WRITTEN TEST & SKILL TEST (Design Labs)

1. **Mechanics of Solids:** Stress and strain, elastic constants, Poisson's ratio; 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.
2. **Kinematics and Dynamics of Machines:** Displacement analysis of planar mechanisms; plane motion of a rigid body; velocity analysis; Coriolis component of acceleration; acceleration analysis; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope, static and dynamic balancing apparatus.
3. **Vibrations:** Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance; critical speeds of shafts, Universal vibration testing machine, whirling shaft apparatus.
4. **Control of mechanical systems:** Basic characteristics of feedback system, open/ closed-loop control and structures; PI, PD and PID controller design, data acquisition system, actuators, sensors; temperature control, pressure and force control, vehicle active suspension control.

5. **General Skills:** Planning & performing simple repair, overhauling of different machines and checking functionality, skills to execute pipe joints, dismantling and assembling valves and fittings. Testing for leakages, planning and performing basic day to day preventive maintenance, and safety aspects.

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**WRITTEN TEST & SKILL TEST (Thermofluids Labs)**

1. **Fluid Mechanics:** Fluid statics, fluid properties, manometry, pressure measurement, buoyancy, stability of floating bodies, Bernoulli's equation and applications, velocity measurement, Measurement of Flow rate, Flow through pipes, head losses in pipes, wind tunnel, Basic principle of fluid mechanics instruments (like Venturi meter, Pitot tube, Orifice meter flow etc.).
2. **Heat Transfer:** Concept of heat and work, Basic modes of heat transfer, One dimensional heat conduction; free and forced convective heat transfer; heat exchanger performance; radiative heat transfer, Basic principle of temperature measurement instruments (like thermometer, thermocouple, RTD, etc.).
3. **Thermodynamics and IC Engine:** 1st Law of Thermodynamics, 2nd Law of Thermodynamics, Thermodynamic processes; Gas power cycle-Carnot, Otto, Diesel, Dual and Brayton cycle; IC Engine Performance.
4. **Turbomachinery:** Classifications, working principles, and performance evaluation of Hydraulic Turbines, Centrifugal Pumps, Vacuum Pumps, reciprocating pumps, compressors.
5. **Refrigeration and Air Conditioning:** Air Cycle; Vapour Compression Refrigeration System; Vapour Absorption Refrigeration; Refrigerants & lubricants; Factors affecting Air conditioning; Psychometric chart and its use; Detection of refrigerants leakage; Refrigeration and Air Conditioning Equipment (like Compressors; Evaporators; Condensers; Humidifiers and Dehumidifiers)
6. **Energy Conversion:** Types of non-conventional energy sources, application of solar energy, different solar energy conversion equipment, instruments for solar energy measurement, wind turbines, tidal turbines, and different biomass conversion processes.
7. **General Skills:** Planning & performing simple repair, overhauling of different machines and checking functionality, skills to execute pipe joints, dismantling and assembling valves and fittings. Testing for leakages, planning and performing basic day to day preventive maintenance, and safety aspects.

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