



**Syllabus for the post of JUNIOR TECHNICAL SUPERINTENDENT**  
**(Metallurgical & Material Engineering)**

**WRITTEN TEST**

**Mechanical Testing:** Tensile, Compression, Hardness, Fatigue, Creep, Impact.

**Heat Treatment:** Heat treatment of steels and aluminium alloys. Surface hardening treatment.

**Metallography:** Sample preparation, Micro and Macro etching. Electropolishing. Microstructure of ferrous and non-ferrous metals.

**Metal casting:** Mould design involving feeding, gating and risering, melting and casting practices, casting defects

**Hot, Warm and Cold Working of Metals:** Metal forming – basics of metal forming processes of rolling, forging, extrusion, wire drawing and sheet metal forming, defects in forming

**Metal Joining:** Principles of soldering, brazing and welding, welding metallurgy, defects in welded joints in steels and aluminium alloys

**Powder Metallurgy:** production of powders, compaction and sintering

**Non-destructive Testing (NDT):** Dye-penetrant, ultrasonic, radiography, eddy current, acoustic emission and magnetic particle inspection methods

**Iron and Steel Making:** Operation of blast furnace. primary steel making: basic oxygen furnace, process dynamics, oxidation reactions, electric arc furnace

**Basics of Phase Diagram of Steels and Aluminium alloys**

**Mineral Beneficiation,** Size classification, flotation, gravity and other methods of mineral beneficiation; agglomeration: sintering, pelletizing and briquetting.

**Electrochemistry and Corrosion:** Single electrode potential, electrochemical cells, Nernst equation, potential-pH diagrams. Forms of corrosion.

**Basics of semiconductor:** Intrinsic and extrinsic semiconductors, doping, donor and acceptor in semiconductor, fermi-level, effective mass, band theory of solids, direct and indirect band gap.

**Semiconductor devices:** p-n junction, diode, capacitor, MOSFET, transistor, logic gates.

**Basics of characterization techniques:** X-ray diffraction, transmission electron microscopy, electron diffraction, atomic force microscopy, scanning electron microscopy, scanning tunnelling microscopy, FTIR, Raman spectroscopy, phase contrast microscopy.

Basic working expertise with maintenance of computers.

**Basic mathematics**

**SKILL TEST**

**Mechanical Testing:** Tensile, Compression, Hardness, Impact.

**Heat Treatment:** Heat treatment of steels and aluminium alloys.

**Metallography:** Sample preparation, Micro and Macro etching, Microstructure of ferrous and nonferrous metals, Optical microscopy.

**Metal casting:** Melting and casting practices.

**Material characterization:** 4 probe method, 2 Probe method,  $M_vH$  &  $M_vT$  measurements, Lithography, UV-visible

Basic skills to operate computational tools.