Syllabus for the post of 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 accepter 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, Mv_sH & Mv_sT measurements, Lithography, UV-visible

Basic skills to operate computational tools.

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