

Syllabus for written test for the post of Foreman Instructor

Engineering Materials: Structure and properties of engineering materials and their applications; effect of strain, strain rate and temperature on mechanical properties of metals and alloys; heat treatment of metals and alloys, its influence on mechanical properties.

Applied Mechanics: Engineering mechanics – equivalent force systems, free body concepts, equations of equilibrium; strength of materials – stress, strain and their relationship, Mohr's circle, deflection of beams, bending and shear stress, Euler's theory of columns.

Theory of Machines and Design: Analysis of planar mechanisms, cams and followers; governors and fly wheels; design of elements – failure theories; design of bolted, riveted and welded joints; design of shafts, keys, spur gears, belt drives, brakes and clutches.

Thermal Engineering: Fluid mechanics – fluid statics, Bernoulli's equation, flow through pipes, equations of continuity and momentum; thermodynamics – zeroth, first and second law of thermodynamics, thermodynamic system and processes, calculation of work and heat for systems and control volumes; air standard cycles; basics of internal combustion engines and steam turbines; heat transfer – fundamentals of conduction, convection and radiation, heat exchangers.

Metal Casting: Casting processes – types and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; solidification; design of casting, gating and risering; casting inspection, defects and remedies.

Metal Forming: Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working – forging, rolling, extrusion, wire and tube drawing; sheet metal working processes such as blanking, piercing, bending, deep drawing, coining and embossing; analysis of rolling, forging, extrusion and wire /rod drawing; metal working defects.

Metal Joining Processes: Welding processes – manual metal arc, MIG, TIG, plasma arc, submerged arc, electroslag, thermit, resistance, forge, friction, and explosive welding; other joining processes – soldering, brazing, braze welding; inspection of welded joints, defects and remedies; introduction to advanced welding processes – ultrasonic, electron beam, laser beam; thermal cutting.

Machining and Machine Tool Operations: Basic machine tools and their parts; machining processes-turning, drilling, boring, milling, shaping, planing, gear cutting, thread production, broaching, grinding, lapping, honing, super finishing; mechanics of machining – geometry of cutting tools, chip formation, cutting forces and power requirements, Merchant's analysis; selection of machining parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability; principles and applications of nontraditional machining processes – USM, AJM, WJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM.

Tool Engineering: Press tools – configuration, design of die and punch; principles of forging die design.

Metrology and Inspection: Limits, fits, and tolerances, interchangeability, selective assembly; linear and angular measurements by mechanical and optical methods, comparators; design of limit gauges; interferometry; measurement of straightness, flatness, roundness, squareness and symmetry; surface finish measurement; inspection of screw threads and gears; alignment testing of machine tools.

Powder Metallurgy: Production of metal powders, compaction and sintering.

Computer Integrated Manufacturing: Basic concepts of CAD, CAM, CAPP, NC, CNC, DNC, Robotics, FMS, and CIM.

Clutches : Requirement of Clutches – Principle of Friction Clutch – Wet Type & Dry Types; Cone Clutch, Single Plate Clutch, Multi plate Clutch.

Power Transmission: Requirements of transmission system; General Arrangement of Power Transmission system; Object of the Gear Box; Different types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchro- mesh Gear Boxes; Epi-cyclic Gear Box, Freewheel Unit. Overdrive unit-Principle of Overdrive, Advantage of Overdrive, Transaxle, Transfer cases. Drive Lines, Universal Joint, Differential and Drive Axles: Effect of driving thrust and torque reactions; Hotchkiss Drive, Torque Tube Drive and radius Rods; Propeller Shaft, Universal Joints, Slip Joint; Constant Velocity Universal Joints; Front Wheel Drive; Principle, Function, Construction & Operation of Differential; Rear Axles.

Suspension Systems: Need of Suspension System, Types of Suspension; factors influencing ride comfort, Suspension Spring; Constructional details and characteristics of leaf springs. Steering System : Conditions for true rolling motions of Wheels during steering; Different types of Steering Gear Boxes.

Automotive Brakes, Tyres & Wheels: Classification of Brakes; Principle and constructional details of Drum Brakes, Disc Brakes.