

# **RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER**

## **SYLLABUS FOR SCREENING TEST FOR THE POST OF DIVISIONAL SUPERINTENDENT RAJASTHAN STATE MOTOR GARAGE**

### **Unit - 1**

Thermodynamics: Basic concepts, gas laws, laws of thermodynamics, thermodynamic processes, Otto, Diesel, and dual cycles. Carnot cycle, Rankine and modified Rankine cycle.

### **Unit - 2**

IC Engines: Air standard efficiency, combustion in SI and CI engines, detonation and knock -causes and variables affecting. Combustion chambers, air fuel system for SI and CI engines, supercharging, fuel injection systems, cooling and lubrication systems, performance and testing of engines. Air pollution due to IC engines and its control.

### **Unit - 3**

Theory of Machines: Kinematics pairs and chains, four bar and slider crank mechanisms and their inversions, flywheels, governors, friction, dynamometers, belt and chain drives, gear and gear trains, balancing of rotating and reciprocating masses, cams, introduction to vibration.

### **Unit - 4**

Materials and Machine Design: Classification and properties of materials, metal structure, ferrous and non-ferrous materials their applications, fundamentals of heat treatment processes. Engineering plastics and fibers.

Design considerations, factor of safety, allowable stresses, design of automobile parts subjected to axial, bending and torsional loadings such as cotter and knuckle joints, shafts, keys and couplings, helical and laminated springs, levers.

### **Unit - 5**

Strength of Materials: Concepts of stress and strain, mechanical properties of materials, Stress-strain diagram, Hooke's law, Poisson's ratio, elastic moduli, principal stresses and strains, Mohr circle, bending moment and shear force diagrams for simply supported and cantilever beams, bending and shear stresses in beams. Column and struts, thin cylindrical shells. Combined direct and bending stresses. Frames.

### **Unit - 6**

Refrigeration and Air Conditioning: Introduction to basic concepts, principles and methods of refrigeration, unit of refrigeration, concepts of COP. Air and vapour refrigeration systems. Vapour absorption and compression systems. Types and desirable properties of refrigerants, modern refrigerants. Psychrometry - processes, charts and their applications. Automobile air conditioning - classification and types, control and air distribution systems. Human comfort.

### **Unit - 7**

Industrial Engineering: Types of organization, principles of plant location and layout. Workstation design, consideration in factory building design. Production planning and control for job, batch and mass production. CPM and PERT. Inspection and quality control - types, objectives and advantages. Work study. Method study - methods, process charts, flow diagrams, SIMO charts, and motion economy. Work measurement - Principles and procedure of work measurement, standard time, rating and allowances. Inventory control, EOQ, ABC analysis. Depreciation - causes, principles and methods. Fleet organization - route planning, vehicle and crew scheduling, road accidents. Motor vehicle acts and laws.

Computer fundamentals - hardware and software, operating systems, peripherals. Simple programming in C/C++. Computer aided design and drafting. Computer applications in inventory management and auto shop management.

## Unit - 8

Workshop and Production Technology: Cutting tools and materials. Specification, classification and main operations of lathe, drilling, shaper, milling and slotter machines. Types, properties and selection of cutting fluids.

Welding - Classification, processes. Electric arc and gas welding. Resistance welding, pressure welding, modern welding processes such as atomic hydrogen welding, TIG, MIG and their applications. Casting techniques, pattern making, core and core making, moulding sands, and cupola. Metal forming processes - forging, extrusion, press forming and drawing. Newer machining methods such as USM, AJM, ECM, ECG, EDM, LBM, EBM - requirements and applications. Plastic moulding processes. Introduction to Jigs and fixtures. Numerical control - components and classification.

## Unit - 9

Fluid Mechanics and Machines: Basic concepts and properties of fluids. Fluid pressure and measurement. Pascal's law. Manometers and mechanical gauges. Hydrostatics. Measurement of fluid flow, Bernoulli's theorem, Pitot tube, venturimeter, orifice meter, orifices and notches.

Flow through pipes, fluid friction. Pipe arrangements. Impact of jets. Classification, construction, and working principles of hydraulic turbines. Turbine performance. Classification, construction, and working principles of centrifugal and reciprocating pumps, trouble shooting and remedies, losses and pump efficiencies. Working principles of hydraulic accumulators, intensifiers, press and torque converter.

## Unit - 10

Auto chassis and body: Classification of automobiles. Chassis and body. Vehicle components, their basic functions and arrangements. Vehicle dimensions. Suspension system, Types of shock absorbers. Braking systems - principles and classifications. Layout, braking efficiency, Hydraulic brakes, brake drums, brake shoes and lining. Hand brake. Modern power brakes. Wheels and types, materials of rim. Tyres - functions and classification and desirable properties. Modern tubeless tyres. Frame - function and loads on frames, construction details, sub frames, frame alignment. Body - types, construction and main features. Body alignment, denting and painting. Window and door regulators. Automobile transmission system - clutch, gear box and differential - their use and construction details. Steering - mechanism and working, power steering, front axle. Auto upholstery.

## Unit - 11

Autoshop and Electricals: Auto shop operation and shop equipments. Repair - trouble shooting - fitting - alignment test of cylinder, cylinder liner, piston, piston rod, connecting rod, cylinder head, brake drum, fuel pump and injector. Calibration and testing. of fuel pump and injector. Introduction to auto electric systems and functions, insulating and earth return systems. Batteries - types, testing, repair, replacement, rating and reserve capacity. Battery chargers - construction details and maintenance. Trouble shooting and testing of batteries. Construction details and use of Alternators, starting motors, ignition systems - requirements of current and voltage, types. Spark plug. Auto lights - types, circuits, switches and wiring. Auto and pressure horns. Modern electrical equipment such as electronic fuel injector, sensors, indicating devices, door locks and power windows.

### Pattern of Question Papers :

- 1 Objective Type Paper.
- 2 Maximum Marks : 100
- 3 Number of Questions : 100
- 4 Duration of Paper : Two Hours.
- 5 All Questions carry equal marks.
- 6 There will be **Negative Marking**.

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