

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF ASSISTANT ENGINEER -MECHANICAL FOR GROUND WATER DEPARTMENT

Part-A

- 40 Questions

Unit-I: History, Culture & Heritage of Rajasthan -

Pre & early history of Rajasthan. Age of Rajputs: Major dynasties of Rajasthan and the achievements of prominent rulers. Emergence of Modern Rajasthan: factors of socio-political awakening of 19th century; Peasants and tribal movements of 20th century; Political struggle of 20th century and the integration of Rajasthan.

Visual Art of Rajasthan - Architecture of forts and temples of Rajasthan; Sculpture traditions of Rajasthan and various schools of painting of Rajasthan.

Performing Arts of Rajasthan - Folk music and musical instruments of Rajasthan; folk dance and folk drama of Rajasthan.

Various religious cults, saints and folk deities of Rajasthan.

Various dialects and its distribution in Rajasthan; literature of Rajasthani language.

Unit-II: Geography, Natural Resource & Socio-Economic Development of Rajasthan -

Geography of Rajasthan: Broad physical features- Mountains, Plateaus, Plains & Desert; Major rivers and lakes; Climate and Agro-climatic regions; Major soil types and distribution; Major forest types and distribution; Demographic characteristics; Desertification, Droughts & Floods, Deforestation, Environmental Pollution and Ecological Concerns.

Economy of Rajasthan: Major Minerals- Metallic & Non- Metallic; Power Resources- Renewable and Non Renewable; Major agro based industries- Textile, Sugar, Paper & Vegetable oil; Poverty and Unemployment; Agro food parks.

Unit-III: Current Events and Issues of Rajasthan and India -

Important Persons, Places and Current events of the State. National and International events of importance. New Schemes & Initiatives taken recently for welfare & development in Rajasthan.

Unit 1: Fluid Mechanics and Fluid Machinery-

Basic definitions and fluid properties, differential equations of continuity and momentum, manometry, buoyancy, forces on submerged bodies, stability of floating bodies, Bernoulli's theorem, Flow through pipes, Laminar and Turbulent flow, Boundary layer and its control, Measurement of flow by Venturi meter, V-notch and Pitot tube, Dimensional analysis, Drag and Lift, Impulse and reaction turbines, Pelton, Francis and Kaplan turbine, their construction, performance and characteristics, specific speed, governing systems, draft tubes, Centrifugal and Reciprocating pumps, Cavitation in pumps, Selection of Pumps and Turbines.

Unit 2: Thermal Engineering-

Thermodynamic systems and processes, Zeroth law of thermodynamics, Properties of pure substances, First law of thermodynamics applied to closed and open systems, Second law of thermodynamics and their applications, Carnot, Otto, Diesel and Dual cycles, Properties of steam, Vapour power cycles like Rankine, modified Rankine and Reheat cycle, Regenerative cycle. Heat transfer processes; thermal conductivity of solids, liquids and gases; boundary conditions, one dimensional heat conduction, critical thickness of insulation; fins, Convection, appropriate nondimensional numbers; flow over flat plate; free and forced convection. Heat Exchangers: Different types of heat exchangers; arithmetic and logarithmic mean temperature differences; heat transfer coefficient for parallel, counter and cross flow type heat exchanger; effectiveness of heat exchanger. Thermal Radiation: Kirchoff's law; radiation intensity, heat exchange between two black bodies, between gray bodies.

Unit 3: Internal Combustion Engines, Refrigeration and Air conditioning, Power Plant Engineering-

Construction and working of 2 stroke and 4 stroke SI and CI Engines, Ideal and actual cycles of operation, fuels, Combustion in SI and CI engines, fuel injection systems, lubrication systems, cooling systems, supercharging, scavenging, engine performance, testing and exhaust emission characteristics

Air Refrigeration System, air-craft air conditioning systems. Heat Pump cycle. COP, Vapor compression refrigeration: Simple cycle, factors affecting performance of vapor compression cycle, actual vapor compression cycle. Suitability of refrigerants for different applications. Vapor Absorption Refrigeration System. Psychrometry and Psychrometric properties, relations,

charts and uses, evaporative cooling, air washers, human comfort, factors affecting comfort, Layout and working principles of Thermal, Hydraulic, Gas and Nuclear power plants. Wind power plants, Solar power plants and other unconventional sources of power.

Unit 4: Theory of Machines-

Types of Kinematics Pair, Mobility, Inversions, Kinematic Analysis, Velocity and Acceleration analysis of Planar Mechanisms, Cams; Gears and Gear Trains, Flywheel and Turning moment diagrams, Gyroscopic action and Gyroscopic couple, Governors, Brakes and clutches, Belt, Rope and Chain drives, Balancing of Rotating and Reciprocating masses.

Fundamentals of vibration: Free and Forced vibration, single degree of freedom. Natural frequency, Principle of conservation of energy, Principles of virtual work. Damping. Forced vibrations: Harmonic excitation, Mechanical impedance, Critical speed, Vibration Isolation, whirling of shafts. Two degree of freedom systems.

Unit 5: Mechanics of Solids, Machine Design and Engineering Materials-

Stress and strain in two dimensions, Principal stresses and strains, isotropy and anisotropy, Uniaxial loading, thermal stresses, Bending moment and shear force diagrams, bending stresses and deflection of beams, Torsion of shafts, Combined stresses, Elastic stability of columns.

Design for strength, Stress concentration, Introduction of various design considerations like strength, stiffness, weight, cost, factor of safety, space etc; Design of shaft, coupling, springs, clutch, brakes, bearings, Gear, thick and thin cylinder, Concept of fracture in ductile and brittle metals, Creep behaviour in metals.

Crystal structure, space lattice, Miller indices, Imperfection in crystals, mechanism of plastic deformation, Theory of work hardening and recrystallization, concept of creep, fatigue and fracture, Phase diagrams, Heat treatment of steels, Plain carbon steel, alloy steels, effect of alloying elements in steel, composition, application and properties of common engineering materials.

Unit 6: Production and Industrial Engineering-

Foundry– Patterns and their allowances, moulding sand and its properties, moulding and casting methods, Principles of welding, brazing and soldering, Metal forming– Rolling, Forging, Extrusion and Drawing, Principles of metal cutting, Various cutting tools, Tool wear and tool life, Jigs and Fixtures,

Economics of machining, Types of machine tools. Standards of measurements, Limits, Fits and Tolerances, Linear and Angular measurements. Numerical control machine tools, CAM, FMS, CIMS, principles of non-traditional machining processes. Type of business, public corporations and co-operative societies, Forms of organization, management structure, work study and productivity, motion study, time study, theory of work sampling, Material handling: functions, engineering & economic factors, Production Planning and Control, Product life cycle, concurrent engineering, types of plant layout

Unit 7: Operation Research and Production Management-

Linear programming, Assignment, Transportation, Game Theory, Statistical quality control, Inventory control, Forecasting, Aggregate planning, MRP, MRP-II, Scheduling. Break-Even analysis, make v/s buy decision, Concept of CPM and PERT.

Scheme of Examination				
S. No.	Subject	No. of Questions	Total Marks	Examination Duration
Part-A	General Knowledge of Rajasthan	40	40	2.30* Hours
Part-B	Concerned Subject	110	110	
	Total	150	150	

1. The competitive examination shall carry 150 marks and 150 questions of Multiple Choice Type questions.
2. There shall be one paper. Duration of Paper will be Two hours and Thirty Minutes.
3. Each question has five options marked as 1,2,3,4,5. You have to darken only one circle (bubble) indicating the correct answer on the Answer Sheet using BLUE BALL POINT PEN.
4. It is mandatory to fill one option for each question.
5. If you are not attempting a question then you have to darken the circle '5'. If none of the five circles is darkened, one third (1/3) part of the marks of question shall be deducted.
6. After solving question paper, candidate must ascertain that he/she has darkened one of the circles (bubbles) for each of the questions. *Extra time of 10 minutes beyond scheduled time, is provided for this.
7. A candidate who has not darkened any of the five circles in more than 10% questions shall be disqualified.
8. Negative marking shall be applicable in the evaluation of answers. For every wrong answer one-third of the marks prescribed for that particular question shall be deducted.
(Wrong answer shall mean an incorrect answer or multiple answers.)
