RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR SCREENING TEST FOR THE POST OF VICE PRINCIPAL/ SUPERINTENDENT, I.T.I., TECHNICAL EDUCATION DEPARTMENT

1 - CIVIL ENGINEERING

1. Engineering Materials & Construction Technology:
   - Building materials: Stones, bricks, cement, lime, paints and timber.

2. Surveying:
   - Chain and compass surveying; leveling; Temporary & Permanent adjustments of level instrument & Theodolite. Use of Theodolite, Tacheometry, Triangulation and Traversing; contours and contouring; Simple, Circular, compound and Transition curves and their setting outs. Theory of Errors and Survey adjustment. EDM Surveys, Photogrammetry and Basics of Remote Sensing.

3. Geotechnical Engineering:
   - Classification of soil as per I.S. Code. Field identification tests for soils; water Content, specific Gravity, Void Ratio; Porosity, Degree of Saturation; Unit Weight, Density Index and their inter-relationship. Determination of various properties of soils, grain size distribution, Atterberg's/consistency limits, etc.

4. Structural Mechanics:
   - Stress and Strains, Elastic constants, Factor of Safety, Relation among elastic constants. Bending moment and shear force diagrams for cantilever, simply supported, overhanging, fixed & continuous beams subjected to static loads; concentrated, uniformly, distributed and uniformly varying loads. Theory of simple bending.
   - Deflection of cantilever, simple supported, fixed and continuous beams. Two and Three hinged arches.

5. Steel Structures:

6. Reinforced Concrete Structures:

7. Fluid Mechanics and Water Resources Engineering:
   - Hydraulic pressure at a point and its measurement, Buoyancy, conditions of equilibrium of floating bodies; fluid properties; Fluid Flow conditions; Bernoulli’s Theorem; Navier-Stokes equation, Flow through orifices, Notches, and weirs; Laminar & Turbulent flow through pipes, flow through open channels, Hydraulic jump. Hydraulic turbines & pumps.
   - Reservoirs and Dams; overflow structures, Irrigation canals, Groundwater and well Irrigation; water-logging.
8 **Environmental Engineering** :
Percapita requirement of water for urban and rural areas; Forecast of population. Sources, water quality standards for public water supplies; various methods of purification; Distribution network with all the ancillaries; systems of drainage; Layout of sewerage systems; Flushing of sewers; sewage treatment; Rural sanitation. Environmental Management aspects. Air Pollution

9 **Highway and Bridges** :
Principles of highway planning; classification of Roads, Alignment, Geometric Design, Traffic Engineering; pavement design for flexible & rigid pavements; paving materials and highway construction, maintenance of different types of roads. Highway drainage and Arboriculture; Types of bridges; choice of type of bridge, Economical considerations of fixing spans, causeways & Culverts.

10. **Construction Planning and Management**
Functions of construction management, Various aspects of construction project planning, project scheduling and controlling. CPM and PERT, Project cost control.

2 - **ELECTRICAL ENGINEERING**


Open & close loop systems, mathematical modeling of dynamic linear systems, transfer functions, block diagrams, signal flow graph, time response analysis, stability of control systems, compensating networks, state variable analysis.

Basic methods of measurement, indicating instruments, measurement of voltage, current power, energy, resistance, inductance, capacitance, frequency, time and flux, current and potential instrument transformers, transducers, cathode ray oscilloscope & digital instruments.

Semiconductor devices and analysis of electronic circuits, oscillators and feedback amplifiers, modulation and demodulation circuits, wave shaping circuits and time base generators, multi-vibrators. Binary system, logic gates, flip-flops, registers, counters, combinational and sequential circuits.

Power generating plants, transmission & distribution systems, load curves, tariffs, basic ideas of power system stability, swing equation, equal area criterion, grid substations, earthing, power system protection, relays, circuit breakers, symmetrical & non-symmetrical fault analysis, voltage & frequency control.

Conversion of a.c. to d.c. and d.c. to a.c. controlled rectifiers, speed control techniques for drives & traction systems. Electrical heating, welding & illumination.

Introduction to 8085/8086 microprocessor, computer architecture, C/C++, JAVA & MATLAB programming.

3 - **MECHANICAL ENGINEERING**

**Engineering Thermodynamics**

**Manufacturing Technology**

Metrology: Dimensional and Geometrical accuracy, Standardization, Limits, fits and tolerances, Design of gauges.
Fluid Mechanics & Machines
Basics of fluid mechanics, Buoyant force, stability of floating and submerged bodies, kinematics of Fluid flow, Dynamics of fluid flow, Dimensional Analysis and Dynamic Similitude, Viscous flow, turbulent flow, Concept of boundary layers, Analysis of pipe flow.
Impact of Free Jet, Homologous units, specific speed, theory of Turbomachines, efficiencies. Methods of classifications, Reaction, impulse and mixed flow turbines, their efficiencies, characteristics, and principles of governing. Draft tube, cavitation, water hammer and surge tanks.
Centrifugal and Reciprocating pumps, air vessels, operating characteristics of these pumps. Miscellaneous machines: Hydraulic accumulator, hydraulic press, lift, ram, coupling and torque converter.

Kinematics of Machines
Links and pairs; kinematics chains; Mechanisms and machines; Inversion; Absolute and relative motions; Instantaneous centres: Acceleration analysis; Cam profiles & different types of followers; cams with specified contours; Fundamental laws of gearing; Types of gears, Gears trains, Belts, rope and chain drives. Efficiency of power transmission

Dynamics of Machines
Concept of free body and its equilibrium; Static & Dynamic force analysis; Fluctuation of energy and speed; Fly wheels & governors. Balancing of rotating masses, Power Screw; Plate and Cone clutches; band and block brakes; Gyroscopic action and Gyroscopic torque. Friction.

Industrial Engineering
Types of forecasting, Facilities Location & Layout Planning, Scheduling, routing, sequencing, Aggregate Production planning, Capacity planning, Inventory Control, Material requirement Planning, Manufacturing Resource Planning, Enterprise Resource Planning

Mechanics of Solid
Concepts and analysis of stresses and strains; mechanical properties; ductile and brittle materials; members in uni-axial state of stress; Transformation of stresses, members subjected to axi-symmetric, torsional and flexural loads; deflection in beams, members subjected to combined loads; elastic stability of columns. Eccentric loading.

Machine Design
Design for strength, Stress concentration. Introduction of various design considerations likes strength, stiffness, weight, cost, factor of safety, space etc; Fatigue consideration in Design, design of welded joints, riveted joint, screwed joints, helical and leaf springs, shafts, Couplings, brakes and clutches. Design of machine members subjected to combined steady & alternating stresses like Bolts and shafts, curved members like crane hooks, crankshafts, camshafts and connecting rod, gear tooth, sliding & journal bearings.Wear and dynamic load consideration. Design of fly-wheel and rotary devices.

Automobile Engineering
Transmission system, steering system, suspension systems, tyres, springs and shock absorbers, brakes and their actuations, ignition systems, Automotive pollution and its control strategies. Legal aspects.

Turbo Machines
Steam Turbines, Steam nozzles, Velocity diagrams, main blade dimensions, thrust; theoretical power and torque, special constructional features of steam turbines, Condensers: performance of condenser; vacuum efficiency.

Heat Transfer
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.
Internal Combustion Engines
Ideal and actual cycles of operation, fuels, Combustion SI and CI engines, carburetors and fuel injection systems for SI engines, fuel injection systems for diesel engines, lubrication systems, cooling systems, supercharging, scavenging, engine performance, testing and exhaust emission characteristics, exhaust pollution, special engines and computer simulation of two stroke and four-stroke engines. Abnormal combustions, knocking and pre-ignition.

Refrigeration & Air-conditioning

Power Plant Engineering

Product Design
Principles of modern design, Human factors in design and applied ergonomics. Product design methods. Legal issues in product design and design resources.

Operations Research

Vibrations

4 - INFORMATION TECHNOLOGY (I.T.)

Computer Organization & Architecture
Digital Logic Family: Logic Gates, Logic functions, Design of Sequential and Combinational Logic Circuits, Number System and data representation.
CPU Design: Design of ALU and Control Unit. Memory Organization, DMA, I/O organization.

Discrete Mathematics

Programming and Data Structures
Data Structure: Stack, Queue, Linked List, Heap Sort, Binary Tree.

Operating System
Computer Networks

Database Management System

Network Management & Information Security

Software Engineering

Data Warehousing & Mining
Data Warehousing: Introduction, Architecture, Implementation, OLAP, Data Cleaning, Data Reduction, Data Integration and Transformation, Data Compression.
Data Mining: Data Mining Concepts, Data Mining Primitives, Architecture of Data Mining System, Data Mining Techniques, Mining Class Comparison, Mining Descriptive Statistical Measures, Associative Rule Mining, Apriori algorithm, Classification and Prediction, Mining of WWW.

Web Design and Development
Introduction to Internet, WWW, Scripting for Web Browser Portability, Client Vs Server Side Web Development, HTML, DHTML, XHTML, Java Script and Introduction to PHP.

Emerging Technologies in the field of IT

5 - ELECTRONICS & COMMUNICATION ENGINEERING

1. Semiconductor Devices:
Intrinsic and extrinsic semiconductors and their properties, p-n junction diode, Tunnel diode, BJT, JFET, MOS, MOSFET, LED, p-I-n and avalanche photo diode, Basics of LASER and MASER. VLSI technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, CMOS process. Power Switching Devices: SCR, GTO, Power MOSFET, Basics of Optoelectronics

2. Analog Circuits:

3. Digital circuits:
Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinational circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift-registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor(8085): architecture, programming, memory and I/O interfacing.
4. **Electronic Measurement and Instrumentation:**

5. **Networks:**

6. **Electromagnetics:**
   Elements of vector calculus; Gauss' and Stokes' theorems, Maxwell's equations, Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies.; Basics of propagation in dielectric waveguide and optical fibers its dispersion and attenuation characteristics; Basics of Antennas: Dipole antennas; radiation pattern; antenna gain.

7. **Signals and Systems:**

8. **Control Systems:**
   Basic control system components; block diagram description, Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID), PD, PI Control Systems. State variable representation and solution of state equation of LTI control systems.

9. **Communications – I**
   Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, superheterodyne receivers; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions.

10. **Communications – II**
6 - COMPUTER SCIENCE

1. **Digital Logic**: Number Systems, Representation and Computer arithmetic (fixed and floating point), Logic functions, Minimization, Combinational and Sequential circuits.

2. **Computer Organization and Architecture**: RAM and ROM, Microprocessor Architecture (8085, 8086), Machine instructions, Addressing modes, ALU, CPU, Control Unit, Memory interface, I/O interface (Interrupt and DMA mode), Microcontrollers, Interfacing, Instruction pipelining, Cache and main memory, Secondary storage.


4. **Data Structures and Algorithms**: Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Heaps, Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths.

5. **Operating System**: Processes, Threads, Inter-process communication, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, I/O systems, Protection and security, Windows, Linux, Mobile OS, Android, RTOS.

6. **Databases**: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), Transactions and concurrency control, Recovery and Failure.

7. **Information Systems and Software Engineering**: Process and Life cycle Models, information gathering, requirement and feasibility analysis, data flow diagrams, UML, process specifications, input/output design, planning and managing the project, design, coding, testing, implementation, maintenance, MIS and ERP.

8. **Computer Networks**: ISO/OSI 7 Layer Stack, LAN Topologies and Internetworking, Routing algorithms, Congestion control, TCP / UDP and sockets, IP (v4 and v6), Application layer protocols (ICMP, DNS, SMTP, POP, FTP, HTTP); Network and Web Security.


Pattern of Question Paper:

1. Objective type question paper.
2. Maximum Marks – 100
3. No. of question – 100
4. Duration of paper – 2 Hours
5. All questions carry equal marks.
6. There will be negative marking.
7. The candidates are required to opt only one subject.