

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER
SYLLABUS FOR SCREENING TEST FOR THE POST OF
INSPECTOR FACTORIES (CHEMISTRY)
(FACTORIES & BOILERS DEPARTMENT)

CHEMICAL ENGINEERING

Process Calculations and Thermodynamics: Laws of conservation of mass and energy, use of tie components, recycle, bypass and purge calculations; degree of freedom analysis. First law of thermodynamics and its application to close and open systems, Second law of thermodynamics, Entropy, thermodynamic properties of pure substances: equation of state and departure function, properties of mixtures, partial molar properties, fugacity, excess properties and activity coefficients.

Fluid Flow Operation: Fluid statics, Newtonian and non-Newtonian fluids, Bernoulli equation and its applications, Orifice and Venturi meter, impulse momentum equation and its application, friction factors, energy balance, dimensional analysis, shell balances, flow through pipeline systems, flow meters, pumps and compressors.

Heat Transfer: Conduction, convection and radiation, heat transfer coefficients, steady and unsteady heat conduction, boiling, condensation and evaporation, types of heat exchangers, evaporators and their design.

Mass Transfer: Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories, momentum, heat and mass transfer analogies, stagewise and continuous contacting and stage efficiencies; HTU and NTU concepts design and operation of equipment for distillation, leaching, liquid-liquid extraction, drying, humidification and dehumidification.

Chemical Reaction Engineering: Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, Constant volume and Varying volume Batch Reactor, Batch Reactor Design Equations, Design Equations for Flow Reactors, Applications of the Design Equations for Continuous-Flow Reactors, Reactors in Series.

Safety in Chemical Process Plant: Safety, hazard and Risk, accident- nature and loss statistic. Hazards: Detection, Management, Recent trends in safety & hazard analysis, hazardous waste treatment, laws, Industrial Hygiene: Identification and evaluation, Source Models: Introduction, spills of toxic, flammable and explosive materials, Fires and Explosions: Distinction, definitions, characteristics and explosion hazard rating of process plant, Preventions of fire and explosions.

Mechanical Operation: Particle size and shape: Measurement and analysis, Screening and screen analysis- Screen effectiveness, working principle of industrial screening equipments, Shape factor, Selectivity index, Size reduction, Principal of comminution, Crushing, Grinding, Pulverization, Ultra fine grinding, Grindability, Crushing laws.

Plant Design and Economics: Design code, Design pressure, Design temperature of cylindrical and spherical shells under internal and external pressures, Process design and sizing of chemical engineering equipment such as compressors, heat exchangers and Boilers; principles of process economics and cost estimation including total annualized cost, cost indexes, rate of return, payback period, discounted cash flow, optimization in design.

Chemical Technology: Inorganic chemical industries; sulfuric acid, NaOH, fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); polymerization industries; polyethylene, polypropylene, PVC and polyester synthetic fibers, Formation and Evaluation of Crude Oil, Testing of Petroleum Products.

Environmental Technology: Classification of air pollutants, Primary and Secondary pollutants, Source of air pollution, Atmospheric Dispersion: Meteorology, Adiabatic lapse rate, Atmospheric stability, Inversion – types of inversion, maximum mixing height, Atmospheric classes, Plumes and types of plumes under different atmospheric condition, plume rise, Characteristic of water and waste water, Oxygen Demand, BOD, NBOD, CBOD, Primary Treatment by Sedimentation, Flocculation, Coagulation, Filtration, Disinfections, Waste water treatment, Biological (secondary) waste water treatment, Advance treatment methods.

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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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