RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS OF COMPETITIVE EXAMINATION FOR THE POST OF INSPECTOR OF FACTORIES (CHEMICAL) (FACTORIES & BOILERS INSPECTION DEPARTMENT) (Dated 26-12-2025)

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, Physical and transport properties of materials and mixtures, Unit systems and dimensions: Dimensional homogeneity and its analysis.

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, flow through pipeline systems, flow meters, pumps and compressors, Pressure drop in pipe network system.

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

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, Performance equation for Mixed flow reactor and Plug flow reactor, Size comparison for single reaction, Multiple reactors, Applications of the Design Equations for Continuous-Flow Reactors.

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, Crushing: Crushing Laws and Crushing equipments, Shape factor, Selectivity index, Size reduction, Principal of comminution, Grinding, Pulverization, Ultra fine grinding, Grindability.

Plant Design and Economics:
Economics of Chemical Industries in India includes demand and its laws, demand curve, elasticity of demand, cost estimation, depreciation, profitability, and economic evaluation of plants using break-even analysis and its applications, 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, optimization in design.

Chemical Technology:
Inorganic chemical industries; sulfuric acid, NaOH, fertilizers (Ammonia, Urea, SSP and TSP), Cement, 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.

Scheme of Examination

Subject	No. of Questions	Total Marks	Examination Duration
Concerned Subject	150	150	2.30 hrs.

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. 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. Explanation: - Wrong answer shall mean an incorrect answer or multiple answers.