

# **ASSISTANT ENGINEER**

## **KERALA WATER AUTHORITY**

### **PART I - CIVIL ENGINEERING**

#### **Environmental Engineering**

Sources of water supply, Quantification of water demand through population forecasting fluctuations in demand, Types of pumps and location of pumping station, Quality of water-Drinking water standards. Physical, chemical and biological analysis, Treatment of water, Theory and principles of Sedimentation tanks, Stoke's law. Types of settling, Coagulation-Mixing, Flocculation, Clariflocculator, Filtration, Types of filters, Rapid sand, Slow sand, and Pressure filters, Methods of Disinfection, Taste and Odour removal. Fluoridation, Defluoridation, Lay out of water distribution network, Methods of distribution-Hardy cross method, Equivalent pipe method.

Waste water Characteristics, Systems of sewerage, Design of circular sewer, Waste water disposal systems, Dilution techniques, land treatment, Self purification of streams, Treatment of sewage, Theory and principles of Screen and Grit chamber, Detritus chamber, Skimming tank, Primary treatment-Sedimentation tank, Trickling filter, Activated sludge process, Septic tank, Oxidation pond. Sludge treatment and disposal methods.

#### **Mechanics of Solids and Structural Analysis**

Stresses and strains, Shear force and bending moment, Moment of inertia, Analysis of frames. Theory of simple bending, Torsion, Columns and struts, Direct and bending stresses. Thin cylinders and thick cylinders, Strain energy, Deflection of beams, Three hinged and two hinged arches, Analysis of frames.

#### **Fluid Mechanics & Water resources Engineering**

Fluid pressure and its measurement. Hydrostatic forces on surfaces, Bernoulli's and Eulers theory, Flow through pipes, Flow through orifice and mouthpieces, Flow over notches and weirs, Open channel flow, Buoyancy, Metacentre, Lock gate. Spillways, River engineering, Design of lined and unlined canals, Canal head works, Cross drainage works.

#### **Surveying and Levelling**

Chain survey, Theodolite survey. Compass survey, Plane table survey, Levelling, Contours, Simpson's rule, Trapezoidal rule, Mass curve.

#### **Building Materials and Construction**

Bricks, Timber, Cement. Concrete, Tests for quality assurance. Estimation, Specification, Valuation. Various components of a building. Bearing capacity of soil. Types of foundation, Earth retaining structures.

## **Design of structures**

Concrete technology, Mix design, Design of RCC structures- working stress and limit state design concepts. Design of retaining walls, bridges and water tanks, prestressed concrete.

Steel structures. Plastic analysis, Working stress and limit state design concepts, Design of connections, water tanks, bridges and trusses.

## **PART II - CHEMICAL ENGINEERING**

### **I. Transfer Processes, Particle Dynamics and Technology**

#### **Momentum transport**

Properties of fluids, principles of fluid statics and dynamics, pressure and flow measurement, material, momentum and energy balance in fluid flow through pipes/conduits and other different geometries, Equation of continuity, equation of motion - Navier-Stoke's equation, Euler equation, Bernoulli's equation and its application for the design of fluid moving machinery. Newtonian and Non-Newtonian flow.

#### **Heat transport**

Concepts of different modes of heat transport, fundamental laws governing the processes and their analysis and applications of heat transfer processes in solids, liquids and gases. Heat transfer equipments

#### **Mass Transport**

Mass Diffusion. Fundamental laws, mass transfer coefficients, theories of diffusion, interphase diffusional transport, drying, adsorption, adsorbents and adsorption processes. Novel Separation processes: Gas permeation processes, reverse osmosis, ultra filtration processes and micro filtration processes, thermal diffusion, sweep diffusion, foam separation and ion-exchange processes. Mass transfer equipments. Concepts of solution thermodynamics.

#### **Particle technology**

Particle size analysis, Solid handling- Particle size distribution, particle shape and size. Concepts involved in size reduction, associated equipments, solid-solid separation: Concepts of different types of settling, sedimentation, precipitation and associated solid-liquid and gas-solid separation equipments, packed beds and fluidized beds. Mixing and agitation-concepts and associated equipments.

### **II. Chemical and Biochemical Reaction Engineering**

Concepts of reactions and their types, limiting and excess reactants, mole balances, conversions and concepts of thermochemistry. Reaction Kinetics: Kinetic rate laws, ideal reactors and isothermal design, multiple reactions, yield and selectivity. Analysis of reactor performance data: Batch reactor data, differential and integral methods, initial rate and half life methods.

Microbial ecology, types of micro organisms, kinetics of microbial and enzyme reactions. Concept of bioreactors, and their different variants. Heterogeneous reactions and reactors.

## **PART III - MECHANICAL ENGINEERING**

**Thermodynamics:** Concepts of thermodynamics, Laws of thermodynamics, Carnot cycle, Air standard cycles, P-V and T-S diagrams.

**Fluid Mechanics and Hydraulic Machines:** Impact of jets, Hydraulic Turbines: Impulse and Reaction and related accessories, Positive displacement pumps, rotodynamic pumps-, selection of pumps - pumping devices - hydraulic ram jet pumps, gear pumps, vane pump and lobe pump. Dimensional analysis

**Heat Transfer:** Modes of heat transfer, equation of heat conduction. Heat conduction through plates, cylinder and sphere, calculation of thermal resistances, Newton' law of cooling, Convective heat transfer coefficient, overall heat transfer coefficient

**Elements of power cycles:** Calorific value, combustion of liquid, solid and gaseous fuels, Boilers, properties of steam, Rankine cycle, Brayton cycle, methods for improving the efficiency of these cycles.

**Refrigeration and air conditioning:** Vapour compression refrigeration system. Types of refrigerants, Psychrometry, Psychrometric properties, Psychrometric processes, air washers, human comfort air conditioning, industrial air conditioning.

**Power transmission devices:** Belt, rope, chain and gear drives. Classification of gears, gear trains, coupling, clutches and brakes.

**Governors:** Types of governors - Watt Porter, Proell and Hartnell governors

**Gyroscopes:** Principle, -analysis of gyroscopic action on vehicles-two wheelers, four wheelers, air planes and ships.

**Balancing:** Static and Dynamic balancing - Balancing of revolving masses in different planes - Balancing of reciprocating mass

**Engineering Materials:** Mechanical properties of engineering materials, Tensile test, Hardness test, Impact test, Ferrous and non-ferrous metals, plastics abrasive materials, ceramics, silicon and glasses.

**Manufacturing process:** Casting, forging, rolling, welding, soldering and brazing. Machining processes, turning, taper turning, thread cutting, shaping, drilling, grinding, milling. Principle, application and advantages of CNC machines. Electro chemical and discharge machining.

**Vibration:** Types of vibrations - Basic elements of a vibrating system - Undamped force vibrations, different methods of analysis,- Free vibrations with viscous damping,- logarithmic decrement, -forced vibrations,- vibration isolation and transmissibility- Force due to unbalance - Force due to support motion - Vibration measuring instruments - vibrometers - accelerometers.

**Design:** Pressure vessels, Thin cylinders, Thick cylinders

*NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.*

**FOLLOW US ON SOCIAL MEDIA PLATFORMS FOR FREE CLASSES**

<https://linktr.ee/winnerstechnical>