

**DETAILED SYLLABUS FOR THE POST OF ASSISTANT EXECUTIVE  
ENGINEER IN APEX SOCIETIES OF CO-OPERATIVE SECTOR IN KERALA**

**(Cat.No.: 208/2020, 209/2020)**

**PART I : CIVIL ENGINEERING**

**Mechanics of Solids and Structural Analysis (7 Marks)**

Concept of stress and strain, Bending moment and shear force, Stresses in beams, Deflection of beams, Theory of columns, Truss analysis, Displacement response of statically determinate structural systems using energy methods, Principle of virtual work, Statically indeterminate structures, Strain Energy methods, Moving loads and influence lines, Arches. Slope Deflection Method, Moment Distribution Method, Clapeyrons Theorem (Three Moment Equation), Kani's method of analysis.

**Fluid Mechanics and Water Resources Engineering (7 Marks)**

Fluid Statics- Fluid pressure, Buoyancy and floatation, Fluid Kinematics, Dynamics of fluid flow, Flow through orifice and notches, Flow through pipes, Boundary layer, Drag and Lift on immersed bodies. Hydraulic machines- flow through vanes (moving and stationary) Impulse and reaction Turbines, Centrifugal Pumps, Open channel flow, Uniform flow, Hydraulic Jump, Gradually varied flow, Dimensional analysis and model testing.

Hydrologic cycle, Precipitation, Infiltration and Evaporation-measurement and data analysis. Runoff-components and computation, Hydrograph, Unit Hydrograph and S-Hydrograph. Irrigation types and methods-Soil water plant relationships, Frequency of irrigation, Computation of crop water requirement. Stream flow measurement -Stage-discharge curve. Meandering of rivers, river training works. Surface water systems: diversion and storage systems, reservoir - estimation of storage capacity and yield of reservoirs - reservoir sedimentation -useful life of reservoir. Groundwater - Aquifer types and properties - Steady radial flow into a well. Estimation of yield of an open well.

**Surveying and Levelling, Quantity Surveying and Valuation (7 Marks)**

Basics of Surveying, Levelling and Contouring, Area and Volume Computation, Theodolite Survey, Mass Diagram, Triangulation, Theory of Errors, Electronic Distance Measurement, Total Station Survey, Global Positioning Systems, Remote Sensing, Geographical Information System

Analysis of rates - Data book and schedule of rates, Analysis of rates for various items of work, Detailed specification. Types of Estimate. Detailed estimate including quantities,

abstract and preparation of various items of works, Preparation of bar bending schedules for various RCC works. Valuation- Methods of valuation, Depreciation, Fixation of rent.

### **Building materials, Construction Technology, Construction Management (7 Marks)**

Construction Materials – Timber, Mortar, Iron and Steel, Structural steel, Modern materials. Concrete–Admixtures, Making of concrete, Properties of concrete, Mix proportioning.

Building construction- Foundations, Cost-effective construction, Masonry, Lintels and arches. Floors and flooring, Roofs and roof coverings, Doors, windows and ventilators, Finishing works. Tall Buildings – Steel and Concrete frame, Prefabricated construction, Slip form construction. Vertical transportation – Stairs, Elevators, Escalators and Ramps. Building failures and Retrofitting, failures in RCC and Steel structures.

Construction Planning and Scheduling, Construction disputes and settlement, Ethics in Construction, Construction safety, Principles of materials management, Quality management practices, Construction procedures.

### **Environmental Engineering (7 Marks)**

Water sources and demand, Quantity estimation, Population forecasting, Quality of water. Water treatment- Physical methods, Chemical methods. Design of sedimentation tank, flocculator, clariflocculator, filters, Membrane treatment techniques. Disinfection methods. Distribution of water, Pumps, Hardy Cross method of analysis

Waste water- Sources, Characteristics, Oxygen demand. Design of sewers, Circular sewers, Partial flow and full flow conditions. Sewer appurtenances, Disposal of wastewater, Streeter Phelps equation, Oxygen sag curve, Treatment methods, Aerobic and anaerobic methods, Design of various treatment units-Screening, Grit chamber, Sedimentation tank, Activated Sludge process, Trickling filter, Rotating biological contactor, Septic tanks, Imhoff tanks, Oxidation ditches, Oxidation ponds, Upflow anaerobic sludge blanket reactors, Sludge digestion, Sludge drying bed. Air pollution-sources, effects on human, Control of air pollutants, Air quality legislations.

### **Design of Structures (5 Marks)**

Limit state method of design, Analysis of reinforced rectangular beams, Shear strength of RC beam, Design of shear reinforcement, Bond and development length, Curtailment of reinforcement, Design for torsion, Design of one way slab, Cantilever slab, Continuous slab (detailing only), Two way slabs, Limit state of serviceability, Deflection, Cracking, Stair cases -design & detailing. Columns-effective length-design of axially loaded short columns with rectangular ties and helical reinforcement.

Columns subjected to compression, Uniaxial bending and biaxial bending, Design of slender columns, Design of wall/strip footing- design of footings, Design of cantilever retaining wall without surcharge, design principles of counter fort retaining wall, Circular

slabs simply supported, fixed and partially fixed subjected to udl, Design of water tanks, Design philosophy and requirements, joints, IS code recommendations, Pre-stressed concrete, Concept of prestressing, materials and methods of prestressing, Prestressing systems, losses of prestress, Analysis of prestressed beams (rectangular and I-sections) at stages of transfer and service

Steel and steel structures – Bolted and welded connections, Tension members, Compression members, Beams, Roof trusses, Purlins. Timber structures- columns, composite beams (concepts only)

### **Geotechnical Engineering**

**(5 Marks)**

Major soil deposits of India, Classification and three phase system of soil, Permeability of soils, Principle of effective stress, Shear characteristics of soil, Consolidation (Terzaghi's theory of one-dimensional consolidation only) and Compaction.

Stability of finite slopes-Swedish Circle Method and Friction circle method, Stresses in subsoil due to loaded areas of various shapes, Boussinesq's formula, Newmark's chart Lateral earth pressure-Rankine's and Coulomb' theories

Bearing capacity of soil, Estimation of magnitude of settlement, Site investigation, Standard Penetration Test and Plate load test, Design of shallow, deep and machine foundations, Ground improvement techniques.

### **Transportation Engineering and Urban Planning**

**(5 Marks)**

Classification and alignment of highways, Geometric design of highways, Properties and testing of pavement materials, CBR method of flexible pavement design, Construction and maintenance of pavements, Design of runways, taxiways and aprons. Traffic characteristics- Traffic studies and analysis, Traffic control devices. Airport characteristics- Aircraft component parts. Site selection, Terminal area planning- Airport marking and lighting. Traffic regulation rules, Highway capacity, Traffic safety, Influencing factors and preventive measures for traffic accidents, Basic diagrams of traffic flow theory. Railways-geometric design of tracks, railway operation control, Maintenance. Alignment, Ventilation and drainage of tunnels, Types of harbours and docks.

Goals and objectives of planning; Components of planning, Regional planning, Theories of urbanization, Study of Urban Forms, Zoning, Development of new towns, Town Development Plan, Town planning acts.

## **PART II ; MECHANICAL ENGINEERING**

### **MODULE – I (ENGINEERING MECHANICS) (7 Marks)**

Statics: Fundamental concepts and laws of mechanics, Rigid body, principle of transmissibility of forces, Coplanar force systems, moment of a force, principle of moments, resultant of force and couple system, Equilibrium of rigid body, free body diagram, conditions of equilibrium in two dimensions, two force and three force members.

### **MODULE – II (MECHANICS OF SOLIDS) (7 Marks)**

Material behavior, uniaxial tension test, stress-strain diagrams, concepts of orthotropy, anisotropy and inelastic behavior, Hooke's law for linearly elastic isotropic material under axial and shear deformation, Definition of stress and strain at a point (introduction to stress and strain tensors and its components only), Poisson's ratio, biaxial and triaxial deformations, Bulk modulus, Relations between elastic constants.

### **MODULE – III (MECHANICS AND DYNAMICS OF MACHINERY) (12 Marks)**

Gears, terminology of spur gears, law of Gearing, involute spur gears involutometry, contact ratio, interference, backlash, gear standardization, interchangeability, centre distance modification, modes of gear tooth failures, theory and details of bevel, helical and worm gearing.

Introduction to vibrations, free vibrations of single degree freedom systems, Energy Method, Undamped and damped free vibrations, viscous damping, critical damping, logarithmic decrement, Coulomb damping, harmonically excited vibrations, Response of an undamped and damped system, transmissibility.

### **MODULE – IV (FLUID MECHANICS AND HEAT TRANSFER) (12 Marks)**

Introduction: Fluids and continuum, Physical properties of fluids, density, specific weight, vapour Pressure, Newton's law of viscosity. Ideal and real fluids, Newtonian and non-Newtonian fluids.

Modes of Heat Transfer, Conduction, Fourier law of heat conduction, Thermal conductivity of solids, liquids and gases, Factors affecting thermal conductivity, Most general heat conduction equation in Cartesian, cylindrical and spherical coordinates, One dimensional steady state conduction with and without heat generation, conduction through plane walls, cylinders and spheres, variable thermal conductivity conduction shape factor, heat transfer through corners and edges. Critical radius of insulation.

## **MODULE – V (INDUSTRIAL AND PRODUCTION ENGINEERING) (12 Marks)**

Management of Human Relations in Organisations: Ethics and fair treatment at work, ethics and the law, ethics fair treatment and justice. Ethical behaviour at work, individual factors, organizational factors, the boss's influence, ethics policies and codes, the organization's culture, role of HR in fostering ethics and fair treatment. Disciplining an employee, formal disciplinary appeals process, discipline without punishment, employee privacy.

Sand Casting: Sand Molds, Types of Molding Sands and Testing Type of patterns, Pattern Materials, Cores, Types and applications, Sand Molding Machines Gating System, Riser, Shell Mold Casting, Ceramic Mold Casting, Investment Casting, Vacuum Casting, Slush Casting, Pressure Casting, Die Casting, Centrifugal Casting, Design Considerations based on Various Shapes, Defects in Castings, simple problems in casting

**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**