

**DETAILED SYLLABUS FOR THE POST OF CHIEF (INDUSTRY AND  
INFRASTRUCTURE DIVISION)  
(KERALA STATE PLANNING BOARD)**

**(CAT.NO.: 249/2022)**

**PAPER I - ECONOMIC PLANNING AND DEVELOPMENT (100 Marks)**

**I Meaning and Measurement of Growth and Development (10 Marks)**

Concepts of Economic Growth and Development, Characteristics of developing economics, National Income Concepts (GNI, NNI, GDP, GVA, GSDP, GNP, NNP, Personal Income, Personal Disposable Income, Transfer Payments, Subsidies). National Income Estimation, Price Level and Inflation, CPI and WPI

**II Indian Economic Planning since independence and Kerala development since 1956 (10 Marks)**

Rationale for Planning, Features and objectives of Economic Planning, Mahalanobis Strategy, New Development Strategy (Resource Allocation 1951-85 and 1985-2017), Sectoral Allocations in Five Year Plans (India and Kerala), Financing Pattern of 11<sup>th</sup> and 12<sup>th</sup> Plan, New Initiatives and Policies - NITI Aayog, Black Economy, Demonetization, Regional Planning in India and Kerala.

**III Government Planning Process, Project Formulation, Appraisal, Implementation and Monitoring (10 Marks)**

State and Decentralized planning process of Kerala, Budget process in Kerala - Role of the state and market - Gender Budgeting, Resource Mobilization and Allocation of Funds in Kerala, Major Centrally Sponsored Schemes (CSS), Role and

functions of NITI Aayog and State planning Commissions/Boards. Types of Planning - Indicative versus Perspective Planning. Project Management - Pre - investment phase - Implementation Phase-Operational Phase-Aspects of Appraisal - Market, Technical and Financial Economic -Basic considerations of risk and return. Project Planning Techniques - Life cycle of a project- tools of project panning, preparation of DPR, Types of Budgeting, Project Monitoring and Evaluation - Outcome Budgeting.

#### **IV Research Methodology and Statistical Approaches (10 Marks)**

Objectives and Types of Research Methods vs Methodology, Identification and formulation of a Research Problem, Critical Research Gap, Review of literature, and Research design and methods, Methods of Sampling Techniques, Descriptive and Inferential statistics, Basic knowledge of statistical packages-SPSS, STATA, Data analyzing, R-Programming, E Views. Ethical Considerations. Extraction of Data from Robust Data Base. Concept of Data Base Management System.

#### **V Industrial and Infrastructure Development (10 Marks)**

Development of Industries in Kerala -Industrial structure - Traditional Industries, MSMEs - PSU, Industrial Policies

Nature and structure of Infrastructure development in Kerala including Transport, Communication, Science and Technology. Trends, patterns and growth of infrastructure in Kerala in the post liberalization period.

#### **VI Labour, Employment and Migration in India and Kerala (10 Marks)**

Occupational structure and Economic Development, Age structure of population and its demographic dividend in India and Kerala, Urbanization in India and Kerala, Socio-economic profile of Labourers in the Un-organized sectors in Kerala. Migration-Emigration and In migration - Dynamics of domestic labour market in Kerala, Entrepreneurialship - Micro enterprises -skill development - Incubation centres, Employment and Poverty, Innovation and Value additions, Rural wages, Employment Generation, Social Security initiatives in Kerala, poverty Alleviation

schemes of India and Kerala

**VII Service delivery and good governance - social audit - gender audit ( 10 Marks)**

Emerging trends in governance, good governance practices, e- governance, use of information technology and communication technology in government business, role and impact of social media in governance, citizen's charter, transparency in governance including policies and initiatives of the government in furtherance of this objective viz., RTI, Lokpal, etc., quality of service delivery, policies and initiatives of the government for inclusive growth & women's empowerment, disaster management, utilization of public funds and such other knowledge of governance which a civil service officer is expected to possess., Governance initiatives through decentralized governance - inclusiveness in governance - Initiatives and Schemes, Administrative Reforms Committee Report, Right based Approach in Governance and Development, Service Led Growth.

**VIII Sustainable Development and Inclusive Growth ( 10 Marks)**

Millennium Development Goals to Sustainable Development Goals, Deprivation and vulnerability - capability approach, entitlements and empowerment, Dimensions of Deprivation and development, HDI - Head count Ratio - Intensity of Poverty - Multidimensional Poverty Index, India's vulnerability to 'Global Warming and Climate Change', Ecological Impact assessment of developmental projects, Integration of environmental costs in budgets and development programmes. Biodiversity and its Conservation and Sustainable Use of natural resources - Initiatives India and Kerala

**IX Emerging Growth Drivers of Kerala Economy (10 Marks)**

Tourism, knowledge economy, energy, Food Processing Industry, IT, S&T etc., HRD - Neighboring groups - Self Help groups and developmental challenges - gender violence - old age - rising dependency ratio - waste management - housing - sanitation - Infrastructure planning and development.

.....

**X IT Information Technology (10 Marks)**

**Module I Computer Hardware**

Technical specifications of desktops/laptops/servers.

Certifications – ROHS, BIS, EPEAT, BEE/Energy Star, UL, CE, FCC.

I/O devices – standard I/O interfaces (PCI Express, SCSI, USB, SATA).

Semiconductor RAMs –semiconductor ROMs –flash memory –cache memory.

Processing unit - microprocessor, microcontroller.

SMPS – UPS – Battery types.

**Module II Operating Systems**

Windows, Linux variants of operating systems.

Licensed software – free software.

Storage Management: disk structure – accessing disks - RAID.

File Concepts – attributes – operations – types – structure – access methods.

File sharing in Windows environment.

**Module III Database Management Systems**

Types of data and DBMS.

Relational Model – concepts and languages, SQL.

Concurrent transaction processing and recovery principles, logs, checkpoints.

Semantic web, RDF, GIS, NoSQL.

**Module IV Data Communication**

Guided transmission media: twisted pair, Coaxial cable, optical fiber.

Wireless transmission, terrestrial microwave, satellite microwave.

Digital carrier system, SONET/SDH.

## **Module V Computer Networks**

LAN –MAN – WAN - PAN, high speed LANs, Wireless LANs - 802.11 standards.

Network hardware devices (Hub, Switch, Modem, Router, Bridge, Repeater)

Network layer – IPv4 – Ipv6 - IP Addressing – subnetting, supernetting.

Application layer –FTP, electronic mail, MIME, SNMP, streaming protocols.

Configuring network services - SSH, web/proxy server, DHCP, DNS, Active Directory.

## **Module VI Web Technologies**

HTML - basic text markup, Cascading Style Sheets.

JavaScript, JSON, XML. Frameworks.

World Wide Web - Web browsers, Hypertext Transfer Protocol. Content Management System.

Full stack programming.

## **Module VII Cyber Security**

Network Security fundamentals. Security policy. Risk analysis.

Firewalls - Types of firewalls, application layer firewalls, packet filtering firewalls, UTM.

Intrusion detection and prevention. Setting up and managing IPS.

Virtual Private Networks, managing VPNs.

End-point security. Cyberforensics.

## **Module VIII Cloud Computing**

Cloud delivery models - Infrastructure-as-a-Service (IaaS), Platform-as-a-Service(PaaS), Software-as-a-Service (SaaS), XaaS (Anything-as-a-service).

Cloud deployment models- Public cloud, Community cloud, Private cloud, Hybrid cloud.

Virtualization – hardware / OS level virtualization, Hypervisors. Storage/Desktop Virtualization.

Internet Service Providers (ISP), Data center technology.

Amazon Web Services, Google Cloud, Microsoft Azure.

## **Module IX Machine Learning & Artificial Intelligence**

Supervised leaning – linear regression, classification, Naive Bayes, Decision tree algorithm.

Neural Network - Multilayer feed forward network, Activation functions (Sigmoid, ReLU), Backpropagation algorithm.

Support Vector Machine.

Unsupervised learning – Clustering. Dimensionality reduction – Principal Component Analysis.

Tools, libraries and platforms for machine learning / deep learning.

Performance measures - Precision, Recall, Accuracy, F-Measure, Receiver Operating Characteristic Curve(ROC). Cross Validation.

## **Module X Emerging Technologies**

Blockchain – concept, applications. Cryptocurrencies.

Payment gateways – Unified Payment Interface – Digital Rupee.

Internet of Things (IoT).

Mobile application development – tools, libraries and platforms.

Technology Management – digital strategy and leadership, forecasting, roadmap, project portfolio.

E-governance and M-governance.

Big data analytics – Apache Hadoop, MapReduce, Apache Spark.

# **PAPER II**

## **PART I : CIVIL ENGINEERING (33 Marks)**

### **1. Mechanics of Solids and Strength of Materials (4 marks)**

Concept of stress and strain, relationship between elastic Constants, Bending moment and shear force, Stresses in beams, beams of uniform strength - beams of two materials – strain energy due to bending - shearing stresses in beams.

Stress on inclined planes for axial and biaxial stress fields - principal stresses - concept of shear centre; Thin and Thick Cylinders, Torsion of solid and hollow circular shafts.

Springs: Close coiled and open coiled helical springs. 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, Clapeyron's Theorem (Three Moment Equation).

## **2. Fluid Mechanics and Water Resources Engineering (4 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. 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 SHydrograph. 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.

## **3. Surveying and Levelling, Quantity Surveying and Valuation (4 Marks)**

Basics of Surveying, Levelling and Contouring, Area and Volume Computation, Theodolite Survey, Mass Diagram. Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Local attraction, Declination, Dip, Latitude and Departure, Methods of orientation, Principle of resection. Principles of levelling- Dumpy level, booking and reducing levels, Methods- simple, differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in leveling. Triangulation, Theory of Errors, Electronic Distance Measurement, Total Station Survey, Global Positioning Systems, Remote Sensing, Contouring: Characteristics, methods, uses. 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.

## **4. Building materials, Construction Technology, Construction Management (5 Marks)**

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

Building construction- 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, PERT, CPM, Construction disputes and settlement, Ethics in Construction, Construction safety, Principles of materials management, Quality management practices, Construction procedures,

#### **5. Design of Structures(4 Marks)**

Properties of concrete and reinforcing steel. Limit state method of design, Analysis of reinforced rectangular beams, Design of shear reinforcement, Bond and development length, Curtailment of reinforcement, Design for torsion, Design of singly and doubly reinforced beams, 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 under compression - effective length- short column - long column - reinforcement-IS specifications regarding columns- design of columns under uniaxial bending. Design of slender columns.

Design of rectangular footings and combined footings (design principles only)- analysis of combined footings-rectangular and trapezoidal.

Fundamentals of Pre-stressed concrete, Concept of prestressing, materials and methods of prestressing systems, losses of pre-stress.

Steel and steel structures – Working stress and Limit state design concepts; Design of tension and compression members, beams and beam- columns, column bases; Connections - simple and eccentric, beam-column connections, plate girders and trusses; Concept of plastic analysis -beams and frames.

#### **6. Geotechnical Engineering (4 Marks)**

Three phase representation system of soil and relationships, index properties, soil structure (single grained, honey comb, flocculent and dispersed structures), basic structural units in clay mineralogy, Permeability of soils, laboratory and field permeability test, Principle of effective stress, seepage pressure, basic definitions and simple computations in flow nets. Stresses in elastic half space due to concentrated loads (Boussinesq equation), contact pressure distribution below foundations.

Consolidation and Compaction. Shear characteristics of soil, Lateral earth pressure Rankine's theory -Bearing capacity of soil, Terzaghi's equation (bearing capacity factors to be provided in the problems), effect of water table, Settlement of soil, immediate and consolidation settlement- computation



Pile foundations, static equation, dynamic equation (engineering news formula only), under reamed piles, vertical and uplift capacity of pile foundations.

Geotechnical investigations, need of investigations, site reconnaissance and its significance, planning of investigations, drilling and sampling, in-situ tests including Standard Penetration Test, vane shear test, pile load test and Plate load test.

## **7. Transportation Engineering and Urban Planning (4 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.. Site selection, Desirable properties and testing of aggregates, bituminous materials and sub grade soil.

Flexible and rigid pavements, Factors influencing the design of pavements, Types and causes of failures in flexible and rigid pavements, Highway drainage.

Definitions in town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning - urbanization, industrialization and urban development; migration trends and impacts on urban and rural development - rural-urban fringes - city region - area of influence and dominance. regional planning: definition, need and importance, function, objective, concept of region, types of regions, delineation of regions - Types and contents of regional planning for block, district, state, nation, NCR, resource region, agro– climatic region, topographic region and sectoral planning, major regional problems and their solutions. Theories of urbanization. Provisions of Town Planning Act, zoning, subdivision practice, metro region concept.

## **8. Environmental Engineering (4 marks)**

Water Supply Engineering: Sources, Estimation, quality standards and testing of water and their treatment; Rural, Institutional and industrial water supply; Physical, chemical and biological characteristics and sources of water, Pollutants in water and its effects, Estimation of water demand; Drinking water Standards, Water Treatment Plants, Water distribution networks.

Waste Water Engineering: Planning & design of domestic wastewater, sewage collection and disposal; Plumbing Systems. Components and layout of sewerage system; Planning & design of Domestic Waste-water disposal system; Sludge management including treatment, disposal and re-use of treated effluents; Industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.

Solid Waste Management: Sources & classification of solid wastes along with planning & design of its management system; Disposal system, Beneficial aspects of wastes, and Utilization by Civil Engineers.

Air, Noise pollution, and Ecology: Concepts & general methodology.

## **PART- II : MECHANICAL ENGINEERING (33 Marks)**

### **9. Materials and Mechanics of Solids (4 Marks)**

Basic Crystallography, Alloys and Phase diagrams, Heat Treatment, Ferrous and Non-Ferrous Metals, Non-metallic materials, Basics of Nano-materials, Mechanical Properties and Testing, Corrosion prevention and control

Analysis of System of Forces, Friction, Centroid and Centre of Gravity.

Torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

### **2, Mechanisms and Machines (5 Marks)**

Types of Kinematics Pair, Mobility, Inversions, Kinematic Analysis, Velocity and Acceleration Analysis of Planar Mechanisms, CAMs with uniform acceleration and retardation, cycloidal motion, oscillating followers; Vibrations –Free and forced vibration of undamped and damped SDOF systems, Transmissibility Ratio, Vibration Isolation, Critical Speed of Shafts. Gears – Geometry of tooth profiles, Law of gearing, Involute profile, Interference, Helical, Spiral and Worm Gears, Gear Trains- Simple, compound and Epicyclic; Dynamic Analysis – Slider – crank mechanisms, turning moment computations, balancing of Revolving & Reciprocating masses, Gyroscopes –Effect of Gyroscopic couple on automobiles, ships and aircrafts, Governors.

### **3. Design of Machine Elements: (3 Marks)**

Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as riveted, welded and bolted joints. Shafts, Spur gears, rolling and sliding contact bearings, Brakes and clutches, flywheels.

### **4. Fluid Mechanics and Turbomachines (5 Marks)**

Properties of Fluids, Manometry, Equations of Motion, Bernoulli's equation and applications, Viscous flow of incompressible fluids, Laminar and Turbulent flows, Flow through pipes and head losses in pipes.

Reciprocating and Rotary pumps, positive displacement pumps, Pelton wheel, Kaplan and Francis Turbines, velocity diagrams, Impulse and Reaction turbines, specific flow, specific speed, pen stock, water hammer. Steam and Gas Turbines, Reciprocating and Rotary Compressors

### **5. Thermodynamics and Heat Transfer (4 Marks)**

Thermodynamic systems and processes; properties of pure substance; Zeroth, First and Second Laws of Thermodynamics; Entropy, Irreversibility and availability; analysis of thermodynamic cycles related to energy conversion: Rankine, Otto, Diesel and Dual Cycles, Rankine and Brayton cycles with regeneration and reheat

Modes of heat transfer, Steady and unsteady heat conduction, Thermal resistance, Fins, Free and forced convection, Correlations for convective heat transfer, Radiative heat transfer – Radiation heat transfer co-efficient; boiling and condensation, Heat exchanger performance analysis.

### **6. IC Engines, Refrigeration and Air conditioning: (3 Marks)**

SI and CI Engines, Engine Systems and Components, Performance characteristics and testing of IC Engines; Fuels; Emissions and Emission Control.

Vapour compression refrigeration, Refrigerants and Working cycles, Compressors, Condensers, Evaporators and Expansion devices, industrial air conditioning, Load calculations

#### **7. Manufacturing and Maintenance Engineering (6 Marks)**

Metal casting-Metal forming, Metal Joining, Machining and machine tool operations, Limits, fits and tolerances, Metrology and inspection, computer Integrated manufacturing, FMS, Failure concepts and characteristics-Reliability, Failure analysis, Machine Vibration, Data acquisition, Fault Detection, Vibration Monitoring, Field Balancing of Rotors, Noise Monitoring, Wear and Debris Analysis, Signature Analysis, NDT Techniques in Condition Monitoring.

#### **8. Renewable Sources of Energy (3 Marks)**

Solar Radiation, Solar Thermal Energy collection - Flat Plate and focusing collectors their materials and performance. Solar Thermal Energy Storage, Applications – heating, cooling and Power Generation; Solar Photovoltaic Conversion; Harnessing of Wind Energy, Bio-mass and Tidal Energy – Methods and Applications, OTEC, Working principles of Fuel Cells.

### **PART-III : MANAGEMENT (34 Marks)**

#### **Quantitative Techniques (19 Marks)**

##### **Module I (6 Marks)**

Theory of Probability: Concept of random experiment: outcomes, sample space, events disjoint events, Classical, frequency and axiomatic probability- Addition rules- Discrete random variables and discrete probability distribution-Continuous random variables and continuous probability distribution- Binomial, poisson distribution- Decision making using probability

##### **Module II (6 Marks)**

Introduction to Statistics: Data presentation using tables and charts- Measurement and scaling- Sampling- Concept- Population and sample- Probability and non-probability sampling- Methods- Hypothesis and testing of hypothesis-Collection of data-Tools-Presentation of data- Graphs, diagrams and frequency distribution

##### **Module III (7 Marks)**

Analysis of Data: Primary and secondary data-Descriptive statistics-Measures of central tendency-Measures of dispersion- Correlation and Regression- Time series analysis- Smoothing techniques- Inferential statistics- tools used under inferential statistics-Data analysis using SPSS and AMOS

#### **Project Management (15 Marks)**

##### **Module I (6 Marks)**

Introduction to Project and Project Management: Introduction to projects: Project report-Preparation of project report-Viability studies – Commercial, economic and financial feasibility-

Consultancy services-Financing of projects- Role of Commercial banks, Development banks, and State/National/ International Corporations/Agencies.-Project management-Unique challenges in the project management environment-Tools and steps in project planning-Introduction to frameworks for project management (Agile, PMBOK)-CPM & PERT-Critical chain project management

### **Module II (6 Marks)**

Techniques, Risk and People Management in Projects: Techniques of project appraisal -NPV, IRR, Payback period, Discounted payback-Earned value management-Project budgeting and cost control-Project cost estimation and cost reduction strategies for ongoing projects-Risk assessment & management in projects-Financial risk assessment-Risk identification, risk prioritization, risk response, risk management strategies-People management in projects stakeholder analysis and management-Manpower planning and staffing in projects-Managing teams in projects-Performance assessment and evaluation of project teams-Project governance and monitoring-Project portfolio management

### **Module III ( 3 Marks)**

Project Modelling and Management with Applications in MS-Project: Project management simulation exercise – Scope, resources and scheduling-Interpreting the output of an MS-Project Report-Resource levelling-Tracking and monitoring project progress

**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.**