FURTHER DETAILS REGARDING MAIN TOPICS OF PROGRAMME No. 04/2020 (Item No: 6)

RESEARCH OFFICER
IN STATE PLANNING BOARD
Category Number : 293/2018

PART I - ECONOMICS

I Decentralized Planning in India and Kerala

Historical Overview-need and objectives of Planning-Types of Planning-Indicative and Perspective Plan-Top down and Bottom up approaches in planning-concept of decentralised planning, Panchayat Raj since independence. Evolution of decentralised planning-73rd and 74th CAA-Delegation to Devolution. Historical Evolution of Local Governments in Kerala-Important milestones in decentralisation in the post 73rd and 74th Amendment period - Transfer of Responsibilities, personnel and transfer of Resources. 12th schedule of the Constitution-Devolution of function-Functionaries – Finance - Freedom of Planning (Participatory) – Local Autonomy.

II Decentralised Planning – Institutions and Methodology

Needs identification – situation analysis, strategy setting, prioritisation and projectisation, Plan Vetting, Plan approval. Vertical and Horizontal integration of Panchayat Raj Institutional plan : Grama Panchayats and Municipalities. Three Tier Governance – Gram Panchayat, Block Panchayat and District Panchayat. Inter-Tier integration of Backward and Forward linkage of projects of one tier with the other tiers of governance – Mechanism adopted to ensure co-ordination between Gram Panchayats and Block Panchayats - Effectiveness of Grama Panchayat to transform its local resources in projectisation (Case study method). Development proposals for various development sectors in Kerala - Agriculture – Irrigation – Watershed development – Animal Husbandry – Fisheries- Industries – Health – Drinking water – infrastructure – Forest – Environment – Mining and Geology - Education – Social Welfare, Women and Child Development – Poverty Resolution – SC & ST's – Tourism – Finance (Case study method). Monitoring and Evaluation mechanism of the schemes at micro level.

III Dimensions of Decentralisation

Devolution of Functions, Functionaries, Finance and Freedom of planning, Functions - mandatory and Discretionary-obligatory – functional assignments among different tiers of LSGIs – XII Schedule of the constitution – Sector wise distribution of responsibilities. Functionaries – transferred from different Line departments to LSGIs - job assignments – duties and responsibilities – issues and challenges. Dual control and job clarity (Case study method). Fiscal Decentralisation – Fiscal devolution – State Finance Commission (SFCs) – Formula – Allocation Appendix IV – other services – Financial planning and Budgeting of tiers of local government, Freedom of Planning – decentralised planning – process of different tiers of the LSGIs – deliberative process – Gramasabha – consultations and discussions – working group functions – situation analysis - Working group reports.

IV Methodology for Beneficiary Selection

Advertisement, through Ward Member, Neighbour Hood Self Help Groups (NHGS), Gramasabha – Role of beneficiary and beneficiary committees in Plan implementation, Gramasabha participation.

V Expenditure Planning under Decentralisation

Macro perspectives – Financial Planning at GP level (Case study method), Sources fo financing the plans – Grants in Aid – own fund – State Sponsored Schemes-Centrally sponsored schemes, co-operative finance, Institutional finance, voluntary contribution, benerificiary contribution and others.

VI Project Management and Impact Study

Problems identification based on felt needs, Types of project social/commercial projects. Background of the project – Identification of the target group – Financial analysis – Feasibility studies – Technical analysis-Environmental Impact analysis – Cost benefit analysis – Mode of implementation – implementation plan – Implementing agencies – departments – Officials transferred to LSGIs – Beneficiary groups – NGOs – Activity calender , monitoring :– projection evaluation and review technique (PERT), Monitoring Committee - Transparency and Accountability – Social Auditing, Evaluation: Conventional, Participatory - Concurrent Outcome of the project indicators – quantitative, qualitative, direct, indirect, SMART: (Specific, Measurable, Attainable, Relevant, Timely) – Impact study-Financial, Economic, Social, cultural, Gender, Environment, Project level Impact – Beneficiary view point – sector level- Agricultural Projects, Irrigation – Animal Husbandry, Sanitation, Drinking Water, Housing, anganvadies, Tribal Sub Plan (Case study method).

PART II - STATISTICS

Module I: Multivariate Analysis

Basic concepts in distribution theory, Multinomial and bivariate normal distributions and their properties; Multivariate normal distribution, properties, characteristic function, standard characteristics, marginal and conditional distributions, distribution of linear combinations of normal variates; Distribution of quadratic forms in normal variables, distribution of sums and quotient of independent quadratic forms, Cochran's theorem; Wishart distribution, partitioned Wishart matrix, Distribution of sample dispersion matrix; Hotelling's T^2, Mahalanobi's D^2; Classification problem- classifying to one of k multivariate normal populations, Bayes solution, Fisher's discriminant function, principal component analysis; canonical variables and canonical correlations, basics of factor analysis and cluster analysis.

Module II: Stochastic Processes and Time Series Analysis

Introduction to Stochastic processes, time and state space, classification of stochastic processes, processes with stationary independent increments, Markov process, renewal process, martingales; Markov chains: Definition, transition probability matrix, n-step transition probability, Chapman-Kolmogorov equation, calculation of n-step transition probability and its limit, classification of states, periodicity, recurrence, ergodic chains; stationary distributions, random walk & gambler's ruin problem; Poisson process, pure birth process, birth and death processes; Stationary processes, strict and weak stationarity, Time Series Analysis: Decomposition of a Time Series, Measurement of Secular Trend, Seasonal Fluctuations, stationary time series: General linear process, Auto covariance, Auto correlation and their properties, Auto covariance generating function, Stationarity and invertibility conditions, Exponential and moving average smoothing.

Module III: Estimation

Point estimation, Sufficiency and minimal sufficiency, Neyman-Pearson factorization theorem, Exponential family of distributions, Unbiased estimation; Completeness, Basu's Theorem; UMVUE estimators and their characterizations, Methods of finding UMVUE, Rao-Blackwell and Lehmann-Scheffe theorems, UMVUE estimation of parametric function from standard distributions; Fisher information measure and its properties, Lower bound to the variance of an unbiased estimates, Cramer-Rao inequality. Chapman-Robbin's bound, Bhattacharya bounds, Efficiency, Consistency; Methods of estimation: Method of moments, Maximum likelihood estimators and their properties, Minimum chi-square and its modification, Least square estimation; Location and scale family of distributions; Elements of Bayesian Inference.

Module IV: Testing of Hypotheses

Neyman-Pearson lemma and its applications, most powerful tests, UMP tests, Unbiasedness, UMPU; LMP, LMPU, tests of hypotheses concerning a real parameter, similar regions, Likelihood ratio tests, asymptotic properties, tests concerning normal distribution (one sample and two samples) and binomial distribution; Sequential procedures, SPRT-Wald's identity- OC and ASN functions, applications to Binomial, Poisson and Normal distributions; Nonparametric tests – Kolmogorov-Smirnov one sample and two sample tests, Sign test, Wilcoxon signed rank test, run test. Median test. Kruskal-Wallis one-way analysis of variance by ranks, Friedman two way analysis of variance by ranks. Kendall's rank order correlation coefficient and Kendall's coefficient of concordance as measure of association.

Module V: Sampling Theory

Ordered and unordered sampling designs, Probability sampling. Simple random sampling with replacement and without replacement. Procedures of selection, Estimation of population mean, total, proportion and variance. Estimation of standard errors of these estimators. Confidence intervals. Determination of sample size. Quota sampling and Snowball sampling; Sampling with varying probabilities: Probability proportional to size (PPS) sampling, Procedure of selecting a PPS sample with and without replacement. Estimation of population mean, total and variance in PPS sampling with replacement. Des Raj ordered estimator, Murthy's unordered estimator, Horvitz-Thompson estimator and their estimated standard errors .Yates–Grundy estimator, Midzuno-Sen scheme of sampling, IPPS sampling; Stratified random sampling; Systematic sampling; single start linear systematic sampling and multiple start systematic sampling, Circular systematic sampling, Estimation of population mean using auxiliary information: Ratio estimator and its properties, Regression estimator and its properties, Regression estimator with double sampling. Separate and combined regression estimators; Cluster sampling with equal and unequal clusters. Non-sampling errors, Various factors, methods of reducing non-response.

PART III - COMMERCE

Module I

Planning: Importance -steps in planning process – types of plans - barriers to planning – nature of objectives – MBO – Strategies and policies – strategy formulation and implementation – strategic planning process – strategic planning tools – policies and procedures – planning premises – types of premises – making premising effective – decision making – importance – process of decision making – types – limiting factor – decision making techniques.

Module II

Organising: Formal and informal organization -span of management – basic departmentation – theories of organization – organization structure types – delegation and decentralization – line and staff authority – committees and group decision making – organisational design and change.

Module III

Co-ordination: Need for coordination – types and techniques for co-ordination – communication channels – role of coordination in organization performance – controlling - features of controlling function – process of controlling - types – relationship between planning and controlling – TQM.

Module IV

Growth Models: Harrod Domar Model – Kaldor Model – Pasinetti Model – Joan Robinson's Model – Meade's neo-classical Model – Solow Model – Feldman Model – Mahalonabis Model – Growth Models in Indian Planning.

Module V

Planning in India: Meaning of Economic planning – need for planning – requisites for successful planning – plan formulation – types – planning techniques – objectives and achievements – planning strategy – resource mobilization – Five Year Plans – Annual Plans – balanced regional development – planning machinery in India and the States – NITI Aayog – State Plans.

PART IV - MATHEMATICS

UNIT I

LINEAR ALGEBRA

Vector spaces: Definition, Examples and properties, Subspaces, Sum and Direct sum of subspaces, Span and linear independence of vectors, Definition of finite dimensional vector spaces, Bases: Definition and existence, Dimension Theorems.

Linear maps, their null spaces and ranges, Operations on linear maps in the set of all linear maps from one space to another , Rank-Nullity Theorem , Matrix of linear map, its invetibilty.

Invariant subspaces, Definition of eigen values and vectors, Polynomials of operators, Upper triangular matrices of linear operators, Equivalent condition for a set of vectors to give an upper triangular operator,Diagonal matrices, Invariant subspaces on real vector spaces.

UNIT II

REAL ANALYSIS

Functions of Bounded Variation and Rectifiable Curves. Properties of monotonic functions, Functions of bounded variation, Total variation, Additive property of total variation, Total variation on [a,x] as a function of x, Function of bounded variation expressed as the difference of increasing functions, Continuous functions of bounded variation, Curves and paths, Rectifiable paths and arc-length, Additive and continuity of arc length, Equivalence of paths, Change of parameter.

The Riemann-Stieltjles Integral. The definition of Riemann-Steiltjles integral, Linear properties, Integration by parts, Change of variable in a Riemann –Stieltjes integral, Reduction to a Riemann integral, Step functions as integrators, Reduction of a Riemann-Stieltjes integral to a finite sum, Euler’s summation formula, Monotonically increasing integrators, Upper and lower integrals, Additive and linearity properties of upper and lower integrals, Riemann’s condition, Comparison Theorems, Integrators of bounded variation, Sufficient conditions for the existence of Riemann-Stieltjes integrals, Differentiation under the integral sign.

Sequences of Functions. Point-wise convergence of sequences of functions, Examples of sequences of real-valued functions, Definition of uniform convergence, Uniform convergence and continuity. The Cauchy condition for uniform convergence, Uniform convergence of infinite series of functions, Uniform convergence and Riemann-Stieltjes integration, Non-uniformly convergent series that can be integrated term by term, Uniform convergence and differentiation, Sufficient conditions for uniform convergence of a series.

UNIT III

DIFFERENTIAL EQUATIONS

Solving second order Linear Equations- The method of Undetermined coefficients, The method of variation of parameters, The method of successive approximations and Picards Theorem.

Series solutions of first order equations - ordinary point - regular singular point - Gauss's Hype geometric equations-The point at infinity, Chebyshev polynomials.

Special functions - Legendre polynomials - Bessel's functions - Gamma functions.

First Order PDE - Curves and Surfaces, Genesis of first order PDE, Classifications of integrals-Linear equation of first order- Pfaffian Differential Equations- Compatible systems- Charpits equations, Jacobi's method.

Second order PDE - Classification of second order PDE - One dimensional wave equations- Vibration of finite string - Vibration of semi infinite string - Vibrations of infinite string, Laplace equations – Boundary value problem, Maximum and minimum principles.

UNIT IV

OPERATIONS RESEARCH

Linear Programming : Formulation of Linear Programming Models, Graphical solution of Linear Programs in two variables, Linear programs in standard form, basic variable, basic solution, basic feasible solution, Solution of Linear Programming problem using simplex method, Big – M simplex method, The two phase simplex method.

Transportation Problems: Linear programming formulation, Initial basic feasible solution, degeneracy in basic feasible solution, Modified distribution method, Optimality test. Assignment Problems: Standard assignment problems, Hungarian method for solving an assignment problem.

Project management; Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM)

Kuhn – Tucker Theory and Non-linear Programming: Lagrangian function, saddle point, Kuhn – Tucker conditions, Primal and dual problems, Quadratic Programming.

Dynamic Programming: Minimum path, Dynamic Programming problems, Computational economy in DP, serial multistage model, Examples of failure, Decomposition, Backward recursion.

UNIT V

FUNCTIONAL ANALYSIS

Normed Spaces and Continuity of Linear maps.

Hahn-Banach Theorem and Banach Spaces.

Uniform Bounded Principle – Closed and Open Mapping Theorems, Bounded inverse Theorems

Spectrum of a Bounded Operator – Dual and Transposes

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