

TAMIL NADU PUBLIC SERVICE COMMISSION
STATISTICS (POST GRADUATE DEGREE STANDARD)

CODE NO: 251

Unit - I: Probability and Random Variables

Instruction to probability: Random Experiments, Sample Space and events, Definition of probability. Classical, Empirical and Axiomatic approach to probability; Addition and Multiplication Theorem, Conditional probability and Baye's Theorem. Random Variables and Distribution function, Distribution Function of a vector and a set of infinitely many Random Variables – Mathematical Expectation and conditional Expectation. Convergence in Probability – Weak Law of large Numbers and strong law of large Number – Central limit Theorem – Chebyshev's inequality.

UNIT – II: Distributions

Introduction to Distributions: Marginal and conditional distributions – Generating functions: - MGF, PGF and CGF – Characteristic function.

Discrete distributions: Binomial, Poisson, Negative binomial and Hyper geometric distribution.

Continuous Distributions: Joint – Marginal – and conditional distributions. Uniform, Normal, Cauchy, Beta, Gamma, Log-Normal, Exponential, Chi-Square, t and F distributions and their properties.

UNIT- III: Estimation Theory

Introduction to Estimation Theory: Unbiasedness, Consistency, Efficiency, Sufficiency and Completeness.

Theorems and Inequalities: Cramer Rao inequality, Chapman-Robin inequality, Rao – Blackwell Theorems, Lehman – Scheffe, Theorem (with examples), - Factorization theorem.

Methods of Estimation: Method of moments, Method of Maximum Chi-Square, Method of Least Square, Bayesian Estimation (with example) – Confidence Intervals for Large and Small Samples.

UNIT – IV: Testing of Hypothesis and Non-Parametric tests

Introduction to Testing of Hypothesis: Simple Null hypothesis, Alternative hypothesis, composite hypothesis, two kinds of Errors – Critical Region – Power function.

Tests: Most Powerful test, Neyman – Pearson Lemma: UMP and Unbiased test, MLR Property and its uses for construction of UMP tests.

Non – Parametric test: Run test – Median test, Sign test – Mann – Whitney test – Wilcoxon test – Komogrov – Smirnov test (one and two sample test procedures), SPRT Test.

UNIT – V: Regression Analysis

Simple and Multiple Regression model: Description of Data Model – Estimation and Test of Hypothesis on Regression Coefficient – Index of fit – Predicated Values and Standard error – Evaluation of Fit – Analysis of Residuals.

Multi – collinearity and its effects on inference and forecasting – Selection of variables – Forward Selection and backward elimination procedures (step wise method).

UNIT – VI: Sampling Theory

Introduction to the theory of Sampling: Sampling designs – estimation procedures – properties of estimations – SRSWOR - Properties of SRSWOR

Systematic, Stratified, Ratio and Regression Sampling methods and Estimate of Double Sampling – Sampling and non – sampling errors – Cluster sampling – Two stage and Multistage sampling – sampling and sample survey organizations – CSO and NSSO.

UNIT – VII: Design of Experiments

Contrasts – linear Constraints – Orthogonal contrasts – linear models – fixed effect model – random effect model – mixed effect model.

Principles of CRD, RBD, LSD, 2^n and 3^n factorial experiments and split plot Design. Partial and complete confounding – BIBD – Youden Square design – Lattice designs PBIBD: Construction and Analysis.

UNIT – VIII: Statistical Quality Control (SQC)

Introduction to statistical process and product control:

Control Charts – Shewart Control Charts for variables and attributes – \bar{X} , R, σ , p, np C and U, Charts – (Both fixed and variable sample size) – CUSUM charts – OC curve for control charts.

Sampling Inspection – 100% sampling Inspection – AOQL. LTPD, producers Risk and consumer, Risk Single, double, Multiple and Sequential sampling plans for attributes – variable sampling plan – OC, ASN, ATI and AOQ curves.

Implementing six sigma – over view and implementations – Examples.

UNIT – IX: Time series and Index numbers

Concepts of time series, additive and multiplicative models, resolutions into Components, determination of trend by free drawing, Moving averages, fitting of mathematical Curves, seasonal indices and the estimate of the variance for random Components, Auto-regressive, Moving averages and ARIMA models.

Definition, Construction interpretation and limitations of index numbers, Lapeyre's Paasche's Marshall – Edgeworth, Fisher's index number and their Comparisons for Good index Number. Construction for cost of living index number and Wholesale price index.

UNIT – X: Applied Statistics through MS-Excel and R – Language

Over view of MS-Excel: Construction of charts and diagrams – Sorting – Filtering – Removing duplicates – Calculation of Measures of Central tendency, Measures of dispersion, correlation Regression and curve fitting using – Excel.

Over view of R Language – Defining the R project – objects and data structures – Graphics using. R language – Calculation of Measures of central tendency, dispersion, Correlation and fitting of Regression line (Linear and logistic).