COURSE NAME: ADVANCED STATISTICS

COURSE CODE: MAT 503

SYLLABUS

Block I. Probability, Random Variable and Distributions:

Basics of Probability: Random experiments, Elementary events, Sample Space, Probability, Translation of events in set theory operation, Axiomatic Probability.

Conditional Probability: Multiplication Theorem of Probability, Independent Events, Pairwise Independent Events, Mutually Independent Events, Bayes' Theorem.

Random Variable: Random variable, Distribution Functions, Discrete Random Variable, Probability Mass Function, Discrete Distribution Function, Continuous Random Variable, Probability Density Function, Continuous Distribution Function.

Two Dimensional Random Variable: Two Dimensional Random Variable Joint probability mass function, Marginal Probability Function, Conditional Probability Function, Two –dimensional Distribution Function, Marginal Distribution Functions, Joint Density Function, Marginal Density Function, Conditional Distribution Function, Stochastic Independence. Transformation of Two Dimensional Random variable.

Block II. Generating Function and Law of Large Numbers:

Mathematical Expectation and Moment Generation Function: Moments, Symmetrical Distribution, Skewness, Kurtosis,Mathematical expectation, Moment generating function, Characteristic function.

Law of Large Numbers: Chebychev's Inequality, Generalised Form of Bienayme-Chebychev's Inequality, Convergence in Probability, Weak Law of Large Numbers(W.L.L.N), Bernoulli's Law of Large Numbers, Morkov's Theorem, Khinchin's Theorem.

Block III Probability Distributions:

Discrete Probability Distributions; Introduction, Discrete uniform Distribution, Bernoulli Distribution, Binomial Distribution, Possion Distribution, Negative Binomial Distribution, Geometric Distribution, Hypergeometric Distribution.

Continuous Probability Distribution; Introduction, Normal Distribution, Central Limit Theorem.

Block IV Correlation& Regression

Correlation; Meaning of Correlation, Scatter Diagram, Karl Pearson's Correlation coefficient, Calculation of the Correlation Coefficient for a bivariate frequency distribution, Rank Correlation.

Regression; Linear regression, Regression Coefficients and properties, Angle between two lines of Regression, Standard error of estimate of residual variance, Curvilinear Regression, Regression Curves.

Block V Concept of Statistical Hypothesis

Basics of Sampling; Population and Sample, Types of Sampling, Statistic and Parameter.

Exact Sampling Distribution-I; Exact Sampling Distribution-I; Chi-square (χ^2) Distribution, Derivation of Chi-square (χ^2) Distribution, M.G.F of Chi-square (χ^2) Distribution, Theorems on Chi-square (χ^2) Distribution.

Exact Sampling Distribution-II; Exact Sampling Distribution-II: Hypothesis, Error, Level of Significance and Procedure,'t' distribution (Student's), F-Distribution, Fisher's z –transformation.z –Distribution.

Theory of Estimation; Point Estimator, Characteristics of Estimator, Unbiasedness, Consistency, Efficiency, Sufficiency.

REFERENCE BOOKS

1. S. C. Gupta and V. K. Kapoor, (2020),*Fundamentals of mathematical statistics*, Sultan Chand & Sons.

2. Seymour Lipschutz and John J. Schiller, (2017),*Schaum's Outline: Introduction to Probability and Statistics*, McGraw Hill Professional.

3. J. S. Milton and J. C. Arnold,(2003), *Introduction to Probability and Statistics* (4th Edition), Tata McGraw-Hill.

4. https://www.wikipedia.org.

SUGGESTED READINGS

1. A.M. Goon,(1998), *Fundamental of Statistics* (7th Edition), 1998.

2. R.V. Hogg and A.T. Craig, (2002), *Introduction to Mathematical Statistics*, MacMacMillan, 2002.

3. Jim Pitman, (1993), *Probability*, Springer-Verlag.

4. https://archive.nptel.ac.in/courses/111/105/111105090