SEMESTER I M. Sc. STATISTICS 2021-22

There will be four core courses and two core course Practicals.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

SEMESTER I M. Sc. STATISTICS 2021-22

M1 STA 01 – CT 01
MEASURE AND INTEGRATION

L-T-P	4-1-0

TIME: 3 hours **External Assessment 80**
Internal Assessment 20

UNIT I

Set operations, Limit of sequence of sets, Classes of sets (rings, σ-rings, fields, σ-fields), Monotone classes, Borel sets, Additive set functions.

UNIT II

Measure, Properties of measure (monotonicity, countable, sub additivity and continuity), Extension of measure, Outer measures. Measurable sets.

UNIT III

Probability measure, Lebesgue, stieltjes measure, Measurable and measure spaces.

UNIT IV

Measurable Functions and its properties. Simple functions, sequence of measurable functions. Integrability of simple and measurable functions.

UNIT V

Properties of integrals, Lebesgue monotone and dominant convergence theorems, Fatou's lemma, Lebesgue-stieltjes integrals.

Books Recommended:

1. Kingman, J.F. and Taylor, S.J. : Introduction to Measure and Probability.
2. Halmos, P.R. : Measure Theory.
3. Ash R.B. : Real Analysis and Probability.
4. Rao, C.R. : Linear statistical Inference and Its Applications.
5. Goldberg R. : Methods of Real Analysis.

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M1 STA 02 – CT 02

MATRICES AND LINEAR ALGEBRA

L-T-P	4-1-0

TIME: 3 hours **External Assessment 80**
Internal Assessment 20

UNIT I

Inverse and partitioning of matrices, Diagonal reduction, Normal form, Vector space, Linear dependence and independence.

UNIT II

Basis, Dimension, Inner product spaces, Orthonormal basis, Gram-Schmidt orthogonalization process and orthogonal projection of a vector.

UNIT III

Characteristic equation, Eigen values and Eigen vectors, Cayley - Hamilton theorem. Minimal polynomial, similar matrices, Algebraic and geometric multiplicity of a characteristic root.

UNIT IV

Bilinear and quadratic forms, Definiteness of quadratic forms, Reduction to canonical forms. Concept of Generalized Inverse, Moore-penrose Generalized Inverse.

UNIT V

Singular values and singular value decomposition, Jordon decomposition, extrema of quadratic forms, vector and matrix differentiation.

Books Recommended:

1. Rao, C.R. : Linear statistical Inference and Its Applications.
2. Kolman, B. : Elementary Linear Algebra.
3. Dutta, K.B. : Matrix and Linear Algebra.
4. Graybill, F.A. (1983) : Matrices with applications in Statistics, IInd Ed., Wadsworth.
5. Biswas, S. (1984) : Topics in Algebra of matrices, Academic publications.
6. Hadley, G. (1987) : Linear Algebra, Narosa publishing House.
7. Roa, A.R. and Bhimasankaram, P. (1992) : Linear Algebra, Tata McGraw Hill.
8. Roa, C.R. and Mitra, S.K. (1971) : Generalized inverse of Matrices and its applications, John Wiley & sons.

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M1 STA 03 – CT 03

PROBABILITY THEORY

L-T-P	3-1-0

TIME: 3 hours **External Assessment 80**
Internal Assessment 20

UNIT I

Role of random experimentation in science Axiomatic approach to probability, sample space. Probability laws for combination of two or more events and its applications. Discrete Probability.

UNIT II

Independence of experiments, conditional probability and Statistical independence of events Baye's theorem (Heat and future) and its applications.

UNIT III

Random variables, Distribution functions Univariate and Multivariate and frequency functions.

UNIT IV

Mathematical expectation, Moments and conditional expectation, Tchebyshev inequality , Markov and Jenson inequalities.

UNIT V

Modes of convergence, Weak and strong law of Large numbers, various definitions of probability and inter-connections, central limit theorem.

Recommended Books:

1. Feller, W. : Introduction to probability Theory and its applications, Vol -I.
2. Rohatgi, V.K. : Introduction to Probability Theory and Mathematical Statistics.
3. Goon and others : An outline of statistical Theory, Vol.-I.
4 Kendall M.G. and Stuart, A. : Advanced Theory of Statistics, Vol.-I.
5 Kolmogorov A.N. : Foundations of Theory of Probability.
6 Parzen, E : Modern Probability Theory and its Applications
7. Gnedenko B.V. : The Theory of Probability.

Reference Books:

1. Cramer H : Mathematical Methods of Statistics.
2. Rao, C.R. : Linear Statistical Inference and its Applications.
3. Mukhopadhyay, P. : Mathematical Statistics.
4. Cacoullos, T : Exercises in Probability.

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M1 STA 04 – CT 04

THEORETICAL DISTRIBUTIONS

L-T-P	3-1-0

TIME: 3 hours **External Assessment 80**
Internal Assessment 20

UNIT I

Generating functions and their applications, Moments and cumulants, Moment generating function and characteristic functions, cumulative function, their properties with proof.

UNIT II

Inversion theorem, derivation of distribution functions from characteristic functions. Central limit theorems for equal and unequal components and applications.

UNIT III

Binomial, Negative-binomial, Poisson, Hyper-geometric and Multinomial distribution with their properties and applications.

UNIT IV

Normal, Rectangular, Cauchy, Laplace, Gamma and Beta distributions. Relation between different distributions.

UNIT V

Compound distributions, Pearsonian System of frequency curves.

Recommended Books:

1. Feller, W. : Introduction to probability Theory and its applications, Vol -I.
2. Rohatgi, V.K. : Introduction to Probability Theory and Mathematical Statistics.
3. Goon and others : An outline of statistical Theory, Vol.-I.
4 Kendall M.G. and Stuart, A. : Advanced Theory of Statistics, Vol.-I.
5 Elderton and Johnson : Systems of Frequency Curves.
6. Wilks S.S. : Mathematical Statistics.

Reference Books:

1. Cramer H : Mathematical Methods of Statistics.
2. Rao, C.R. : Linear Statistical Inference and its Applications.
3. Mukhopadhyay, P. : Mathematical Statistics.
4. Cacoullos, T : Exercises in Probability.

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SEMESTER I M. Sc. STATISTICS 2021-22

M1 STA 05 – CP 01
PRACTICALS BASED ON STATISTICAL METHODS
(Using MS-Excel & SPSS)

L-T-P	0-0-6

Duration: 4 Hours **External Assessment 80**
Internal Assessment 20

External Assessment 80: Practicals : 60 Marks
Viva-Voce : 20 Marks

Internal Assessment 20: Practical Record (Internal Assessment) : 20 Marks

Note: Students will be required to do practicals, based on topics listed below, using Excel & SPSS:

List of Practical:

1. Presentation of raw data
2. Graphical representation by (i) Histogram (ii) Frequency polygon (iii) Frequency curve and (iv) Ogives.
3. Diagrammatic representation by (i) Bars (ii) Pie diagram.
4. Graphical plots: Box-Whisker plots, Histograms and Population Pyramids.
5. Measures of Central Tendency: Mean Median, Mode, G.M., H.M., Quartiles, and Deciles & Percentiles.
6. Measures of Dispersion (i) Range (ii) Semi interquartile range (iii) Mean Deviation (iv) Standard Deviation and Variance (v) Coefficient of Variation (vi) Lorenz Curve.
7. Moments and various measures of Skewness and Kurtosis.
8. Fitting of curves: (i) Straight line (ii) Parabola (iii) Exponential and Power curves.
9. Computation of simple, multiple, partial and rank correlation coefficients.
10. Computation of simple regression and test for intercept and slope.
11. Calculation of correlation coefficient by
    (i) Karl Pearson's method and (ii) Spearman's rank method.
12. Construction of regression line.
13. Preparation of bivariate frequency distribution, calculation of correlation coefficient and construction of regression lines.
14. Calculation of Multiple and Partial correlation coefficients and construction of multiple regression equations (for three variables only).

Books for reference:

1. Goon and others : An outline of Statistical theory, Vol. I.
2. Rohatgi, V. K. : An Introduction to Probability Theory and Mathematical Statistics.

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M1 STA 06 – CP 02

PRACTICALS BASED ON CT-03 & CT-04

L-T-P	0-0-6

Duration: 4 Hours **External Assessment 80**
Internal Assessment 20

External Assessment 80: Practicals : 60 Marks
Viva-Voce : 20 Marks

Internal Assessment 20: Practical Record (Internal Assessment) : 20 Marks

Students will be required to do practicals, based on topics listed below, using Excel & SPSS:

List of Practicals:

1. Random number generation.(i) Binomial, (ii) Poisson, (iii) Normal
2. Fitting of Binomial distribution when p is known and when p is unknown.
3. Fitting of Poisson distribution when parameter is known and unknown.
4. Fitting of Normal and Negative -binomial distributions.
5. Calculation of area under normal curves.
6. Plot probability curves for different sets of parameters.
7. Test for normality: P-P Plot, Q-Q Plot etc.
8. Practical using generating functions such as MGF, PGF, CGF, CFs..
9. Software development of above practical problems in Excell & SPSS and running the same on computers.

Books for reference:

1. Goon and others : An outline of Statistical theory, Vol. I.
2. Rohatgi, V. K. : An Introduction to Probability Theory and Mathematical Statistics.