AC 25.04.24 ITEM NO: 24.2

Deccan Education Society's

Kirti M. Doongursee College of Arts, Science and Commerce (AUTONOMOUS)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for
Program: Bachelor of Science
Course: S.Y.B.Sc.
Subject: Statistics

Choice Based Credit System (CBCS)
with effect from
Academic Year 2024-2025

PROGRAM OUTCOMES

PO	Description
A student completing Bachelor's Degree in **Science** Program will be able to	
PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate Programme. Execute strong theoretical and practical understanding generated from the specific graduate Programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**Social competence:** Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	**Research-related skills and Scientific temper:** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Performing dependently and collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centered national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

Deccan Education Society's

Kirti M. Doongursee College (Autonomous)

Proposed Curriculum as per NEP 2020

Year of implementation- 2024-25

Name of the Department: Statistics

Semester	Course Code	Course Title	Vertical	Credit
III	24STATMJ311	Probability Distributions-I	Major	2
	24STATMJ312	Sampling Theory	Major	2
	24STATMJP31	Practical-I	Major	2
	24STATMR321	Statistical Techniques-II	Minor	2
	24STATMRP31	Practical-I	Minor	2
	24STATEOE331	Introduction to Statistics – II	OE	2
	24STATVC341	Statistics Using R-Software	VSC	2
IV	24STATMJ411	Probability Distributions-II	Major	2
	24STATMJ412	Analysis of Variance & Design of Experiments	Major	2
	24STATMJP41	Practical-II	Major	2
	24STATMR421	Correlation and Regression Analysis	Minor	2
	24STATMRP41	Practical-II	Minor	2
	24STATEOE431	Applied Statistics	OE	2
	24STATSE451	Introduction To R-Software	SEC	2

Course Code	MAJOR SEM – III	Credits	Lectures /Week
24STATMJ311	**Paper I - Probability Distributions-I**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to

- Understand different standard discrete probability distributions.
- Differentiate between the standard discrete probability distributions, understand their properties.
- Solve problems after identifying the underlying distribution.

Unit	Topics	No of Lectures
I	**Moment Generating Function(M.G.F.):** **Definition** Properties: a) Effect of change of origin and scale, b) M.G.F of sum of two independent random variables X and Y, c) Extension of this property for 'n' independent random variables and for 'n' i.i.d. random variables. d) All above properties with proof, e) Uniqueness Property without proof. f) Raw moments using M.G.F: using expansion method and using derivative method. **Cumulant generating Function(C.G.F.):** a) Definition and Properties b) Effect of change and origin and scale, c) Additive Property of C.G.F. and Cumulants, both properties with proof. d) Obtaining Cumulants using C.G.F. e) Derivation of relationship between moments and Cumulants up to order four. **Characteristic Function:** a) Definition and properties (without Proof) b) Examples of obtaining raw moments and	**15**

	central moments up to order four using M.G.F. and C.G.F. for continuous and discrete distributions. **Degenerate distribution:** a) (One point distribution) P(X=c) =1 b) Mean, Variance, Use of Degenerate distribution. **Discrete Uniform distribution**. a) Mean, Variance, coefficient of skewness using m.g.f. **Bernoulli distribution:** a) Mean, Variance, coefficient of skewness using m.g.f. **Binomial distribution:** a) Mean, Variance, Measures of skewness and Kurtosis based on moments using M.G.F. and C.G.F., Additive property, b) If X follows Binomial, then to find distribution of n-X. c) Recurrence relation for moments with proof. $\mu'_{r+1} = np\mu'_r + pq\frac{d}{dp}\mu'_r$ $\mu_{r+1} = pq[nr\mu_{r-1} + \frac{d}{dp}\mu_r]$ d) Relation between Bernoulli and Binomial using m.g.f. e) Transformation of random Variable (Univariate): examples based on it.	
II	**Standard Discrete Probability Distributions** **Poisson distribution:** a) Mean, Variance, Measures of skewness and Kurtosis based on moments using M.G.F. and C.G.F., Additive property. b) Recurrence relation for moments with proof for μ'_{r+1} μ_{r+1} c) If X and Y are two independent Poisson variables Conditional distribution of X given X+Y with proof d) Poisson distribution as limiting distribution of Binomial (with proof). e) Real life examples of Binomial, Poisson distribution.	**15**

Geometric Distribution:

a) Definition in terms of No. of failures and No. of trials.
b) Mean, Variance, M.G.F., Mean and Variance using M.G.F., C.G.F., Mean and Variance, μ_3, μ_4 using C.G.F., Coefficients of skewness and Kurtosis and nature of probability distribution.
c) Lack of Memory property with proof.
d) If X and Y are two i.i.d. Geometric variables; Conditional distribution of X given X+Y with proof.
e) Distribution of sum of k i.i.d. Geometric variables.

Negative Binomial Distribution:

a) Definition, Mean, Variance, M.G.F., Mean and Variance using M.G.F., C.G.F.,
b) Recurrence relation for central moments, Mean, Variance, μ_3, μ_4 using C.G.F.,
c) Coefficients of skewness and Kurtosis.
d) Lack of Memory property (without proof).
e) Recurrence relation for probabilities, fitting of distribution.
f) Limiting distribution of Negative Binomial distribution (with proof).

Hyper geometric distribution:

a) Definition, Mean, Variance, Limiting distribution of Hyper geometric distribution (with proof).
b) If X and Y are two independent Binomial variables, Conditional distribution of X given X+Y (with proof).

Truncated distribution:

a) Definition
b) Truncated Binomial and Truncated Poisson Distribution: (truncated at 0)
c) Probability mass function, mean and variance.

- Real life situations of Geometric, Negative Binomial, Hypergeometric distributions.

Textbooks:

- Gholba-Vaze-Daptardar: Probability distributions, Vipul Prakashan.

Additional References:

- Introduction to Mathematical Statistics: R.V.Hogg, A.T. Craig; Fourth Edition; Collier McMillanPublishers.
- Probability and Statistical Inference: R.V.Hogg, E. A.Tannis, Third Edition; Collier McMillan Publishers.
- Introduction to Mathematical Statistics: P.G. Hoel; Fourth Edition; John Wiley & Sons Inc.
- Fundamentals of Mathematical Statistics: S.C. Gupta, V.K. Kapoor; Eighth Edition; Sultan Chand & Sons.

Course Code	MAJOR SEM – III	Credits	Lectures /Week
24STATMJ312	Paper II - Sampling Theory	2	2

Course Outcomes:

After successful completion of this course, students would be able to

- Understand the need of sampling and define the principal concepts in sampling.
- Formulate and calculate estimates of population parameters for Simple random sampling.
- Formulate and calculate estimates of population parameters for Stratified sampling,

Unit	Topics	No of Lectures
I	**Concepts:** a) Population, Population unit, Sample, Sample unit, Parameter, Statistic, Estimator, Bias, Unbiased, Mean square error & Standard error. b) Census survey, Sample Survey. Steps in conducting sample survey with examples on designing appropriate Questionnaire. c) Concepts of Sampling and Non-sampling errors. d) NSSO, CSO and their functions. e) Concepts and methods of Probability and Non-Probability Sampling. **Simple Random Sampling: (SRS).** a) Definition, Sampling with & without replacement (WR/WOR). b) Lottery method & use of Random numbers to select Simple random sample. c) Estimation of population mean & total. d) Expectation & Variance of the estimators, Unbiased estimator of	15

	variance of these estimators. (WR/WOR). e) Estimation of population proportion. f) Expectation & Variance of the estimators, Unbiased estimator of variance of these estimators(WR/WOR). g) Estimation of Sample size based on a desired accuracy in case of SRS for variables & attributes. (WR/WOR) (Without Proof).	
II	**Stratified Sampling:** a) Need for Stratification of population with suitable examples. b) Definition of StratifiedSample. c) Advantages of stratified Sampling. **Stratified Random Sampling:** a) Estimation of population mean & total in case of Stratified Random Sampling (WOR within each strata). b) Expectation & Variance of the unbiased estimators, Unbiased estimators of variances of these estimators. c) Proportional allocation, Optimum allocation with and without varying costs. d) Comparisonof Simple Random Sampling, Stratified Random Sampling using Proportional allocation and Neyman allocation.	**15**

Textbooks:

- Milan Gholba: Theory of sampling, Vipul Prakashan.

Additional References:

- Sampling Techniques: W.G. Cochran; 3rd Edition; Wiley(1978)
- Sampling Theory and methods: M.N. Murthy; Statistical Publishing Society. (1967)
- Sampling Theory: Des Raj; McGraw Hill Series in Probability and Statistics. (1968).
- Sampling Theory of Surveys with Applications: P.V. Sukhatme and B.V. Sukhatme; 3rd Edition; Iowa State University Press (1984).
- Fundamentals of Applied Statistics: S. C. Gupta and V.K. Kapoor; 3rd Edition; Sultan Chand and Sons (2001).
- Theory and Analysis of Sample Survey Designs: Daroga Singh, F.S.Chaudhary, Wiley Eastern Ltd. (1986).
- Sampling Theory and Methods: S. Sampath, Second Edition (2005),Narosa.
- Theory and Methods of Survey Sampling: Parimal Mukhopadhyay, (1998), Prentice Hall Of India Pvt. Ltd.

Course Code	SEM III	Credits	Lectures/ Week
24STATMJP31	**Practical - I**	**2**	**4**

Course Outcomes:

After successful completion of this course, students would be able to:

- Compute probabilities of standard probability distributions.
- Utilize techniques for fitting standard discrete distributions to empirical data sets.
- Draw random samples by various sampling methods.
- Design questionnaires for collecting data in various scenarios, ensuring clarity and relevance of questions.

Paper I	
1	Moment Generating Function, Moments.
2	Cumulant generating Function, Cumulants, Characteristic function.
3	Standard Discrete Distributions.
4	Fitting Standard Discrete Distributions.
5	Transformation of discrete & continuous random variables.
Paper II	
1	Designing of Questionnaire.
2	Simple Random Sampling for Variables.
3	Simple Random Sampling for Attributes.
4	Estimation of Sample Size in Simple Random Sampling.
5	Stratified Random Sampling.

Course Code	MINOR SEM – III	Credits	Lectures /Week
24STATMR321	Paper I- Statistical Techniques-II	2	2

Course Outcomes:

After successful completion of this course, students would be able to

- Define the concept of random variable and its probability distribution including properties.
- Discuss basic rules of Probability.
- Compute the probabilities of different events.
- Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- Identify and relate standard discrete probability distributions to real world problems.

Unit	Topics	No of Lectures
I	**Elementary Probability Theory** a) Trial, random experiment, sample point and sample space. b) Definition of an event. Operation of events, mutually exclusive and exhaustive events. c) Classical (Mathematical) and Empirical definitions of Probability and their properties. d) Theorems on Addition and Multiplication of probabilities. e) Independence of events, pairwise and mutual independence for two event, Conditional probability.	15
II	**Discrete Random Variable and Some Standard Discrete Distributions** a) Random variable. Definition and properties of probability distribution and cumulative distribution function of discrete random variable.	15

	b) Raw and Central moments (definition only) and their relationship (up to order three). c) Expectation of a random variable. Theorems on Expectation & Variance. d) Joint probability mass function of two discrete random variables. e) Marginal and conditional distributions. Theorems on Expectation & Variance, Covariance and Coefficient of Correlation. Independence of two random variables. f) Bernoulli, Binomial and Poisson distributions and derivation of their mean and variance.	

Textbooks:

- Gholba-Phatak: Statistical Methods, Vipul Prakashan.
- Welling-Khandeparkar: Statistical Methods, Manan Prakashan.
- Dr. Kore B. G. and Dr. Dixit P. G.: "Elementary Probability Theory", Nirali Prakashan, Pune.

Additional References:

- Gupta V. K. & Kapoor S. C.: Fundamentals of Mathematical Statistics, Sultan & Chand.
- Mood A. M., Graybill F. A. and Boes D. C.: Introduction to the Theory of Statistics, McGraw Hill.
- Hogg, R. V., Tanis, E.A. and Rao J.M.: Probability and Statistical Inference, Seventh Edition, Pearson Education, New Delhi.

Course Code	MINOR SEM - III	Credits	Lectures/ Week
24STATMRP31	**Practical - I**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to:

- Apply the laws of probability.
- Find various measures of discrete random variable and probabilities using its probability distribution.
- Know the applications of some standard discrete probability distributions.

Paper I	
1	Probability
2	Discrete Random Variables
3	Bivariate Probability Distributions
4	Binomial distribution
5	Poisson distribution

Course Code	OE SEM – III	Credits	Lectures /Week
24STATOE331	Introduction to Statistics - II	2	2

Course Outcomes:

After successful completion of this course, students would be able to

- Define the concept of random variable and its probability distribution including properties.
- Discuss basic rules of Probability.
- Compute the probabilities of different events.
- Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.
- Identify and relate standard discrete probability distributions to real world problems.

Unit	Topics	No of Lectures
I	**Elementary Probability Theory** f) Trial, random experiment, sample point and sample space. g) Definition of an event. Operation of events, mutually exclusive and exhaustive events. h) Classical (Mathematical) and Empirical definitions of Probability and their properties. i) Theorems on Addition and Multiplication of probabilities. j) Independence of events, pairwise and mutual independence for two event, Conditional probability.	15
II	**Discrete Random Variable and Some Standard Discrete Distributions** g) Random variable. Definition and properties of probability distribution and cumulative distribution function of discrete random variable.	15

	h) Raw and Central moments (definition only) and their relationship (up to order three). i) Expectation of a random variable. Theorems on Expectation & Variance. j) Joint probability mass function of two discrete random variables. k) Marginal and conditional distributions. Theorems on Expectation & Variance, Covariance and Coefficient of Correlation. Independence of two random variables. l) Bernoulli, Binomial and Poisson distributions and derivation of their mean and variance.	

Textbooks:

- Gholba-Phatak: Statistical Methods, Vipul Prakashan.
- Welling-Khandeparkar: Statistical Methods, Manan Prakashan.
- Dr. Kore B. G. and Dr. Dixit P. G.: "Elementary Probability Theory", Nirali Prakashan, Pune.

Additional References:

- Gupta V. K. & Kapoor S. C.: Fundamentals of Mathematical Statistics, Sultan & Chand.
- Mood A. M., Graybill F. A. and Boes D. C.: Introduction to the Theory of Statistics, McGraw Hill.
- Hogg, R. V., Tanis, E.A. and Rao J.M.: Probability and Statistical Inference, Seventh Edition, Pearson Education, New Delhi.

Course Code	VOCATIONAL SKILL COURSE SEM – III	Credits	Lectures /Week
24STATVC341	Statistics Using R-Software	2	2

Course Outcomes:

After successful completion of this course, students would be able to

- Understand basic syntax and data structures in R, including vectors, matrices, data frames, and lists.
- Develop skills in creating a variety of graphical representations including histograms, bar plots, scatter plots, and box plots using R.
- Compute and interpret measures of central tendency such as mean, median, and mode using R.
- Calculate and interpret measures of dispersion including range, variance, standard deviation, and interquartile range using R.
- Learn how to compute probabilities, percentiles, and cumulative distribution functions for various distributions using R functions.

1	Fundamentals of R
2	Graphs and Diagrams using R
3	Measures of Central Tendency using R
4	Measures of Dispersion using R
5	Probability distributions using R

Course Code	MAJOR SEM – IV	Credits	Lectures /Week
24STATMJ411	**Paper I – Probability Distributions - II**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to

- Understand different Standard continuous probability distributions.
- Differentiate between that standard continuous probability distributions, understand their properties and solve problems based on these distributions.
- Apply standard continuous probability distributions in real life examples.

Unit	Topics	No of Lectures
I	**Standard Continuous Probability Distributions:** **Rectangular or Continuous Uniform** over (a, b) a) Mean, Median Standard deviation, C.D.F., M.G.F., Mean, variance, μ_3 using M.G.F., skewness of distribution. **Exponential Distribution** a) Definition, M.G.F., C.G.F. raw moments and central moments up to order four using M.G.F. and C.G.F. b) Forgetfulness Property with proof and examples based on it (Without Proof). c) Distribution of ratio of two i.i.d. Exponential random variables. **Cauchy (with location and scale parameter)** a) Properties. b) Quartiles and percentiles. **Gamma (with Scale and shape parameter)** a) Expression for r^{th} raw moment. b) Mean, variance & Standard deviation. c) M.G.F., Additive property, C.G.F.. raw moments and central moments up to order four using M.G.F.. and C.G.F. d) Coefficients of skewness and Kurtosis. e) Distribution of sum of independent exponential random variables.	**15**

	Beta Distribution: Type I & Type II: a) Expression for r^{th} raw moment, Mean and Standard deviation. b) If a r.v. X follows Beta of type 1, distribution of 1- X. **Normal Distribution:** a) Definition, Derivation of Mean, Median, Mode, Standard deviation, M.G.F., C..G,F., Moments & Cumulants (up to fourth order). skewness & kurtosis, Nature of Normalcurve, b) Mean absolute deviation. c) Properties of Normal Distribution. d) Expression for even order central moments and to show that odd order centralmoments are zero. Percentiles. e) Distribution of Standard normal variable, Percentiles. Distribution of linear function of independent Normal variables (i)aX, (ii). X+b, (iii). aX+bY in particular X+Y and X-Y, (iv) $\sum_{i=1}^{p} a_i x_i$ (all with proof) f) Fitting of Normal Distribution. g) Central Limit theorem for i.i.d. random variables.(with proof) h) Log Normal Distribution: Derivation of mean & variance. i) Distribution of product of n log normal random variables.	
II	**Exact Sampling Distributions:** **Chi-Square Distribution:** a) Derivation of p.d.f., Concept of degrees of freedom. Mean, Mode & Standard deviation. M.G.F., C.G.F., Measures of skewness and Kurtosis, Additive property. b) Distribution of ratio of two independent Chi-square	**15**

variables

c) Distribution of $\frac{X}{x+Y}$ if X and Y are two independent

Chi-square variables(All with proof).

d) Distribution of the sum of squares of independent Standard Normal variables.

e) Sampling distributions of sample mean and sample variance and their independencefor a sample drawn from Normal distribution (with proof).

Applications of Chi-Square:

a) Development of decision criterion with test procedures of

(i) Test of significance for specified value of variance of a Normal population

(ii) Test for goodness of fit

b) Test Procedure for independence of attributes.

(i) r×c contingency table,

(ii) 2× 2 contingency table, Derivation of test statistic, Yates' correction withproof

c) Derivation of Confidence interval for the variance of a Normal population when

(i) mean is known,

(ii) mean is unknown.

Student's t-distribution:

a) Derivation of p.d.f. , Mean, Median, Mean Deviation & Standard deviation.

b) M.G.F., C.G.F. , Measures of skewness and Kurtosis and Additive property

c) Limiting distribution of t distribution with proof.

Applications of t:

a) Development of decision criterion with test procedure of Test of significance for specified value of mean of Normal population.

b) Test procedure of test of significance for difference between means of:

(i) Two independent Normal populations with equal variances

(ii) Dependent samples (Paired t test)

c) Derivation of Confidence intervals for:

(i) Mean of Normal population,

(ii) Difference between means of two independent Normal populations having the same variance.

	Snedecor's F-distribution: a) Derivation of p.d.f. , Expression for r^{th} raw moment, Mean, variance, Mode & Standard deviation b) Distribution of Reciprocal of F variable with proof. c) Applications of F: Test procedure for testing equality of variances of two independent Normal populations (i) Mean is known (ii) Mean is unknown d) Derivation of confidence interval for ratio of variances of two independent Normal populations	

Textbooks:

- Gholba-Vaze-Daptardar: Probability and Sampling Distributions, Vipul Prakashan.

Additional References:

- Probability and Statistical Inference: R.V.Hogg, E. A.Tannis, Third Edition; Collier McMillan Publishers.
- Introduction to Mathematical Statistics: P.G. Hoel; Fourth Edition; John Wiley & Sons Inc.
- Fundamentals of Mathematical Statistics: S.C. Gupta, V.K. Kapoor; Eighth Edition; Sultan Chand & Sons.

Course Code	MAJOR SEM – IV	Credits	Lectures /Week
24STATMJ412	**Paper II - Analysis of Variance &Design of Experiments**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to

- Demonstrate analysis of one-way and two-way classification.
- Explain the different components of ANOVA Table.
- Define fundamental concepts in Designs of Experiment, describe the principles of designs of experiment and list the different types of experimental designs.
- Analyze CRD, RBD and LSD using ANOVA.

Unit	Topics	No of Lectures
I	**Analysis of Variance:** a) Introduction, Uses, Cochran's Theorem (Statement only). b) One-way classification with equal & unequal observations per class c) Two-way classification with one observation per cell. d) Mathematical Model, Assumptions, Expectation of various sums of squares, F-test, Analysis of variance table. e) Least square estimators of the parameters, Variance of the estimators.	**15**
II	**Design of Experiments:** a) **Concepts**: Experiments, Experimental unit, Treatment, Yield, Block, Replicate,Experimental Error, Precision. b) Principles of Design of Experiments: Replication, Randomization & Local Control. c) Efficiency of design D_1 with respect to design D_2. d) Choice of size, shape of plots & blocks in	**15**

	agricultural & nonagricultural experiments. **Completely Randomized Design (CRD) & Randomized Block Design (RBD):** a) Mathematical Model, Assumptions, Expectation of various sums of squares, F-test, Analysis of variance table. b) Least square estimators of the parameters, Variance of the estimators, c) Efficiency of RBD relative to a CRD.	

Textbooks:

- Milan Gholba: Analysis of Variance and Design of Experiments , Vipul Prakashan.

Additional References:

- Experimental Designs: W.G. Cochran and G.M.Cox; Second Edition;John Wiley and Sons.
- The Design and Analysis of Experiments: Oscar Kempthorne, John Wiley and Sons.
- Design and Analysis of Experiments: Douglas C Montgomery; 6th Edition;John Wiley & Sons.
- Design and Analysis of Experiments: M.N.Das and N.C.Giri, 2nd Edition; New Age International (P) Limited;1986.
- Experimental Design, Theory and Application: Walter T Federer; Oxford & IBH Publishing Co. Pvt. Ltd.
- Fundamentals of Applied Statistics: S.C.Gupta and V.K.Kapoor; 3rd Edition; Sultan Chand and Sons (2001).
- Statistical Principles in Experimental Design: B.J. Winer, McGraw Hill Book Company.

Course Code	SEM IV	Credits	Lectures/ Week
24STATMJP41	**Practical - II**	**2**	**4**

Course Outcomes:

After successful completion of this course, students would be able to:

- Understand the central limit theorem and its implications for sampling distributions.
- Apply standard continuous probability distributions in real life examples.
- Analyze variance in two-way experimental designs to assess main effects and interaction effects between factors.
- Knowledge of using an appropriate experimental design to analyze the experimental data.
- Perform ANOVA using R software.

Paper I	
1	Standard Continuous Distributions
2	Normal Distribution
3	Chi-square Distribution
4	t-distribution
5	F-distribution
Paper II	
1	Analysis of Variance- One Way.
2	Analysis of Variance- Two Way.
3	Completely Randomized Design.
4	Randomized Block Design.
5	Analysis of Variance Using R-software

Course Code	MINOR SEM – IV	Credits	Lectures /Week
24STATMR421	**Correlation and Regression Analysis**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to:

- Understand the concept of correlation coefficient and its relationship by using different methods of correlation.
- Apply least square method to the linear / Non-linear data for establishing relationship between two variables.
- Carry out a simple linear regression and interpret regression coefficient and coefficient of determination.
- Compute the correlation between two variables and its interpretation.
- Fit regression line and different types of curves using the method of least squares.

Unit	Topics	No of Lectures
I	**Correlation Analysis**: a) Scatter Diagram. b) Product moment correlation coefficient and its properties. c) Spearman's Rank correlation. (With and without ties)	**15**
II	**Regression Analysis:** a) Concept of linear regression. b) Principle of least squares. Fitting a straight line by method of least squares. c) Relation between regression coefficients and correlation coefficients.	**15**

Textbooks:

- Gholba-Phatak-Jardosh: Descriptive Statistics, Vipul Prakashan.
- Welling-Khandeparkar: Descriptive Statistics, Manan Prakashan.
- Dr. Kore B G. and Dr. Dixit P. G.: Descriptive Statistics I, Nirali Prakashan, Pune

Additional References:

- Gupta V. K. & Kapoor S. C.: Fundamentals of Mathematical Statistics, Sultan & Chand
- Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics
- Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.

Course Code	MINOR SEM - IV	Credits	Lectures/ Week
24STATMRP41	**Practical - II**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to:

- Carry out a simple linear regression and interpret regression coefficient and coefficient of determination.
- Compute the correlation between two variables and its interpretation.
- Fit regression line and different types of curves using the method of least squares.

Paper I	
1	Correlation Analysis - I
2	Correlation Analysis - II
3	Regression Analysis - I
4	Regression Analysis - II
5	Revision Practical

Course Code	OE SEM – IV	Credits	Lectures /Week
24STATOE431	**Applied Statistics**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to:

- Understand the concept of correlation coefficient and its relationship by using different methods of correlation.
- Apply least square method to the linear / Non-linear data for establishing relationship between two variables.
- Carry out a simple linear regression and interpret regression coefficient and coefficient of determination.
- Compute the correlation between two variables and its interpretation.
- Fit regression line and different types of curves using the method of least squares.

Unit	Topics	No of Lectures
I	**Correlation Analysis**: d) Scatter Diagram. e) Product moment correlation coefficient and its properties. f) Spearman's Rank correlation. (With and without ties)	**15**
II	**Regression Analysis:** d) Concept of linear regression. e) Principle of least squares. Fitting a straight line by method of least squares. f) Relation between regression coefficients and correlation coefficients.	**15**

Textbooks:

- Gholba-Phatak-Jardosh: Descriptive Statistics, Vipul Prakashan.
- Welling-Khandeparkar: Descriptive Statistics, Manan Prakashan.
- Dr. Kore B G. and Dr. Dixit P. G.: Descriptive Statistics I, Nirali Prakashan, Pune

Additional References:

- Gupta V. K. & Kapoor S. C.: Fundamentals of Mathematical Statistics, Sultan & Chand
- Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics
- Gupta S. P. (2002): Statistical Methods, Sultan Chand and Sons, New Delhi.

Course Code	SKILL ENHANCEMENT COURSE SEM – IV	Credits	Lectures /Week
24STATSE451	**Introduction To R-Software**	**2**	**2**

Course Outcomes:

After successful completion of this course, students would be able to

- Install R, managing packages, and navigating the R environment.
- Import, manipulate, and export data efficiently using R.
- Understand basic syntax and data structures in R, including vectors, matrices, data frames, and lists.
- Develop skills in creating a variety of graphical representations including histograms, bar plots, scatter plots, and box plots using R.
- Perform various mathematical operations using R.

1	Fundamentals of R
2	Data Structures in R
3	Mathematical Operations using R
4	Graphs and Diagrams using R
5	Descriptive Statistics using R

Evaluation Scheme for Second Year (UG) under NEP

(2 credits)

I. Internal Evaluation for Theory Courses – 20 Marks

1) Continuous Internal Assessment(CIA) Assignment - Tutorial/ Case Study/ Project / Presentations/ Group Discussion / Ind. Visit. – 10 marks

2) Continuous Internal Assessment(CIA) ONLINE Unit Test – 10 marks

II. External Examination for Theory Courses – 30 Marks

Duration: 1 Hours

Theory question paper pattern: All questions are compulsory.

Question	Based on	Marks
Q.1	Unit I	15
Q.2	Unit II	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

III. Practical Examination

- Each core subject carries 50 Marks.
- Duration: 2 Hours for each practical course.
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam

NOTE: To pass the examination, attendance is compulsory in both Internal & External (Theory + Practical) Examinations.