GOVERNMENT DEGEE COLLEGE (A) :: NAGARI

STATISTICS MINOR SYLLABUS

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	II	1	Descriptive Statistics	3	3
			Descriptive Statistics Practical Course	2	1
II	III	2	Statistical Methods	3	3
			Statistical Methods Practical Course	2	1
	IV	3	Design and Analysis of Experiments	3	3
			Design and Analysis of Experiments Practical Course	2	1
		4	Numerical Analysis	3	3
			Numerical Analysis Practical Course	2	1

SEMESTER-II

COURSE 1: DESCRIPTIVE STATISTICS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To acquaint with the role of statistics in different fields with special reference to business and economics.
2. To review good practice in presentation and the format most applicable to their own data.
3. To learn the measures of central tendency or averages reduce the data to a single value which is highly useful for making comparative studies.
4. To familiar with the measures of dispersion throw light on reliability of average and control of variability.
5. To deal with the situation where there is uncertainty and to measure that uncertainty by using the probability, which is essential in all research areas.

II. Syllabus

Unit – 1: Statistical Description of Data

Origin, history and definitions of Statistics. Importance, Scope and limitations Statistics. Function of Statistics – Collection, Presentation, Analysis and Interpretation. Collection of data - primary and secondary data and its methods. Classification of data – Quantitative, Qualitative, Temporal, Spatial. Presentation of data – Textual, Tabular – essential parts.

Unit – 2:

Measurement Scales – Nominal, Ordinal, Ratio and Interval. Frequency distribution and types of frequency distributions, forming a frequency distribution. Diagrammatic representation of data – Histogram, Bar, Multiple bar and Pie with simple problems. Graphical representation of data: Histogram, frequency polygon and Ogives with simple problems.

Unit – 3: Measures of Central Tendency (MCT)

Arithmetic Mean – properties, methods. Median, Mode, Geometric Mean (GM), Harmonic Mean (HM). Calculation of mean, median, mode, GM and HM for grouped and ungrouped data. Median and Mode through graph. Empirical relation between mean, media and mode. Features of good average.

Unit – 4: Measures of Dispersion

Concept and problems – Range, Quartile Deviation, Mean Deviation and Standard Deviation, Variance. Central and Non – Central moments and their interrelationship. Sheppard's correction for moments. Skewness and its methods, kurtosis.

Unit – 5: Elementary Probability

Basic Concepts of Probability, random experiments, trial, outcome, sample space, event, mutually exclusive and exhaustive events, equally likely and favourable outcomes. Mathematical, Statistical, axiomatic definitions of probability. Conditional Probability and independence of events, Addition and multiplication theorems of probability for 2 and for n events and simple problems. Boole's inequality, Bayes theorem and its applications in real life problems.

SEMESTER-II

COURSE 1: DESCRIPTIVE STATISTICS

Practical Credits: 1 2 hrs/week

Syllabus

1. Writing a Questionnaire in different situations.
2. Forming a grouped and ungrouped frequency distribution table.
3. Diagrammatic presentation of data – Bar, multiple Bar and Pie.
4. Graphical presentation of data – Histogram, frequency polygon, Ogives.
5. Computation of measures of central tendency – Mean, Median and Mode.
6. Computation of measures of dispersion – Q.D., M.D and S.D.
7. Computation of non-central, central moments, β_1 and β_2 for ungrouped data.
8. Computation of non-central, central moments, β_1 and β_2 and Sheppard's corrections for grouped data.
9. Computation of Karl Pearson's and Bowley's Coefficients of Skewness.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS word for writing inference.

III. References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
3. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.
4. K. Rohatgi & Ehsanes Saleh: An Introduction to Probability and Statistics, John Wiley & Sons.

IV. Suggested Co-curricular Activities:

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc. on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
5. Collection of material/figures/photos/author photoes of related topics.
6. Invited lectures and presentations of stalwarts to those topics.
7. Visits/field trips of firms, research organizations etc.

SEMESTER-III

COURSE 2: STATISTICAL METHODS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To get the knowledge of estimating future values by using curve fitting.
2. To calculate the relationship between bivariate data.
3. To find the relationship about the multivariate data.
4. To acquaint about the forecasting of the data by using regression techniques.
5. To find the association of the categorical data by using attributes.

II. Syllabus

Unit – 1: Curve fitting

Bivariate data, Principle of least squares, fitting of k^{th} degree polynomial. Fitting of straight line, Fitting of Second degree polynomial or parabola, fitting of family of exponential curves and power curve.

Unit – 2: Correlation

Meaning, Types of Correlation, Measures of Correlation – Scatter diagram, Karl Pearson's Coefficient of Correlation, Rank Correlation Coefficient (with and without ties), Properties. Bivariate frequency distribution, correlation coefficient for bivariate data and problems. Lag and Lead in correlation.

Unit – 3:

Coefficient of concurrent deviation, probable error and its properties, coefficient of determination, Concept of multiple and partial correlation coefficients (three variables only), properties and problems, intra-class correlation and correlation ratio.

Unit – 4: Regression

Concept of Regression, Linear and Non Linear regression. Linear Regression – Regression lines, Regression coefficients and it properties, Angle between two lines of regression. Regressions lines for bivariate data and simple problems. Correlation vs regression. Explained and Unexplained variations.

Unit – 5: Attributes

Notations, Class, Order of class frequencies, Ultimate class frequencies, Consistency of data, Conditions for consistency of data for 2 and 3 attributes only , Independence of attributes , Association of attributes and its measures, Relationship between association and colligation of attributes, Contingency table: Square contingency**,** Mean square contingency, Coefficient of mean square contingency, Tschuprow's coefficient of contingency.

SEMESTER-III

COURSE 2: STATISTICAL METHODS

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. Fitting of straight line by the method of least squares
2. Fitting of parabola by the method of least squares
3. Fitting of exponential curve of two types by the method of least squares.
4. Fitting of power curve of the type by the method of least squares.
5. Computation of correlation coefficient and regression lines for ungrouped data.
6. Computation of correlation coefficient for bivariate frequency distribution.
7. Computation of correlation coefficient, forming regression lines for grouped data.
8. Computation of partial and multiple correlation coefficients.
9. Computation of Yule's coefficient of association and colligation.
10. Computation of Pearson's, Tschuprow's coefficient of contingency.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS word for writing inference.

III. References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
2. O. P. Gupta: Mathematical Statistics, Kedar nath Ram nath & Co.
3. P. N. Arora & S. Arora: Quantitative Aptitude Statistics – Vol II, S. Chand & Company Ltd.
4. K. Rohatgi & Ehsanes Saleh: An Introduction to Probability and Statistics, John Wiley & Sons.

IV. Suggested Co-curricular Activities:

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
5. Collection of material/figures/photos/author photoes of related topics.
6. Invited lectures and presentations of stalwarts to those topics.
7. Visits/field trips of firms, research organizations etc.

DESIGN AND ANALYSIS OF EXPERIMENTS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After successful completion of the course students will be able to:

1. To acquaint with the role of statistics in different fields with special reference to agriculture.
2. Learn to apply the one of the design of experiment to agricultural fields.
3. Learn to apply the randomization to the blocks of various fields in agriculture.
4. To get the familiarity about applications of three principles.
5. Learn to deal the agricultural fields with different factors and levels.
6. To use appropriate experimental designs to analyze the experimental data.

II. Syllabus

Unit – 1: Analysis of variance (ANOVA)

Concept, Definition and assumptions. ANOVA one way classification – mathematical model, analysis – with equal and unequal classification. ANOVA two way classification – mathematical model, analysis and problems.

Unit – 2: Completely Randomised Design (CRD)

Definition, terminology, Principles of design of experiments, CRD – Concept, advantages and disadvantages, applications, Layout, Statistical analysis. Critical Differences when hypothesis is significant.

Unit – 3: Randomised Block Design (RBD)

Concept, advantages and disadvantages, applications, Layout, Statistical analysis and Critical Differences. Efficiency of RBD relative to CRD. RBD with one missing value and its analysis, problems.

Unit – 4: Latin Square Design

Concept, advantages and disadvantages, applications, Layout, Statistical analysis and Critical Differences. Efficiency of LSD over RBD and CRD. Estimation of one missing value in LSD and its analysis, problems.

Unit – 5: Factorial experiments

Main effects and interaction effects of 2^2 and 2^3 factorial experiments and their Statistical analysis. Yates procedure to find factorial effect totals.

DESIGN AND ANALYSIS OF EXPERIMENTS

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. ANOVA - one - way classification with equal number of observations.
2. ANOVA - one - way classification with unequal number of observations.
3. ANOVA Two-way classification.
4. Analysis of CRD and critical differences.
5. Analysis of RBD and critical differences. Relative efficiency of CRD with RBD.
6. Estimation of single missing observation in RBD and its analysis.
7. Analysis of LSD and efficiency of LSD over CRD and RBD.
8. Estimation of single missing observation in LSD and its analysis.
9. Analysis of 2^2 with RBD layout.
10. Analysis of 2^3 with RBD layout.

Note: Training shall be on establishing formulae in Excel cells and derive the results. The excel output shall be exported to MS word for writing inference.

I. References

1. S. C. Gupta & V. K. Kapoor: Fundamentals of Applied Statistics, Sultan Chand&Sons, New Delhi.
2. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC. PHI.
3. M. R. Saluja: Indian Official Statistics. ISI publications.

II. Suggested Co-curricular Activities:

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
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6. Invited lectures and presentations of stalwarts to those topics.
7. Visits/field trips of firms, research organizations etc.

NUMERICAL ANALYSIS

Theory Credits: 3 3 hrs/week

I. Learning Outcomes

After learning this course the student will be able

1. Learn the different difference operators and applications.
2. Accustom with the interpolation techniques with equal and unequal intervals.
3. Able to use numerical differentiation tools.
4. Familiar to use numerical integration methods.

II. Syllabus

Unit 1

Definitions of Forward difference operator (Δ), Backward difference operator, Shift or Extension (displacement) operator (E), Central Differences operator(μ), Differentiation operator(D), Mean value operator Symbolic relations between operators, properties of difference and shift operators, fundamental theorem on finite differences and simple problems.

Unit 2

Interpolation with equal intervals: Concept of interpolation and extrapolation, assumptions and uses of interpolation, difference tables, methods of interpolation with equal intervals - Newton's formula for forward and backward interpolation, Central differences, Gauss forward and backward, Sterling, Bessel's and Laplace - Everett's Formulae.

Unit 3

Interpolation with unequal intervals: Divided differences and their properties. Methods of interpolation with unequal intervals – Newton's Divided difference formula and Lagrange's formula. Inverse interpolation - Lagrange's formula.

Unit 4

Numerical Differentiation: Introduction to Numerical differentiation. Determination of First and Second order derivatives for the given data using Newton's forward and backward, Gauss forward and backward, Sterling, Bessel's and Newton's Divided difference formula.

Unit 5

Numerical Integration: Introduction to numerical integration, General Quadrature formula for equidistant ordinates, Trapezoidal rule, Simpson's $1/3^{rd}$, Simpson's $3/8^{th}$ rule and Weddle's rule.

Practical Credits: 1 2 hrs/week

Practical Syllabus

1. Interpolation by using Newton-Gregory forward and backward difference formulae.
2. Interpolation by using Gauss forward and backward difference formulae.
3. Interpolation by using Sterling and Bessel's formulae.
4. Interpolation by using Laplace-Everett's Formula.
5. Interpolation by using Newton's divided difference and Lagrange's formulae.
6. Inverse interpolation by using Lagrange's formula.
7. Determination of first and second order derivatives by using Newton-Gregory forward and backward difference formulae.
8. Determination of first and second order derivatives by using Gauss forward and backward difference formulae.
9. Determination of first and second order derivatives by using Newton's divided difference formula.
10. Numerical Integration by using Trapezoidal rule, Simpson's $1/3^{rd}$, Simpson's $3/8^{th}$ rule and Weddle's rule.

III. References

1. H. C. Saxena: Finite Differences and Numerical Analysis, S. Chand and Company, New Delhi.
2. P. P. Gupta, G. S. Malik & Sanjay Gupta: Calculus of Finite Differences and Numerical Analysis, Krishna Prakashan Media(P) Ltd., Meerut(UP), India.
3. S. S. Sastry: Introductory Methods Numerical Analysis, Prentice- Hall of India.
4. C. F. Gerald and P. O. Wheatley: Applied Numerical Analysis, Addison- Wesley, 1998.

IV. Suggested Co-curricular Activities:

1. Training of students by related industrial experts
2. Assignments including technical assignments if any.
3. Seminars, Group Discussions, Quiz, Debates etc on related topics.
4. Preparation of audio and videos on tools of diagrammatic and graphical representations.
5. Collection of material/figures/photos/author photoes of related topics.
6. Invited lectures and presentations of stalwarts to those topics.
7. Visits/field trips of firms, research

REVISED UG SYLLABUS UNDER CBCS w.e.f 2020-21
PROGRAMME: FOUR YEAR B.Sc.,B.A.,

Skill Enhancement Courses (SECs) for Semester V,
from 2022-23 (Syllabus-Curriculum)

Year	Sem	Paper	Title	No. of Theory Hours per Week	IE Marks	EE Marks	Total	Credits
III	V	6A	OPERATION RESEARCH - I	3	25	75	100	3
			Practicals	3	-	50	50	2
		7A	OPERATION RESEARCH - II	3	25	75	100	3
			Practicals	3	-	50	50	2

Course 6A: OPERATION RESEARCH - I
(Skill Enhancement Course(Elective), 05 Credits
Max.Marks: Theory :100 Practicals: 50

Objective: The objective of the paper is to introduce the basic concepts of operational Research and linear programming to the students.

Learning Outcomes:
After learning this course, the student will be able

1. To acquire knowledge and develop analysis skills on industrial experimentation and quality related data using advance statistical methods
2. To know the OR techniques with business environment and life sciences
3. To convert real life problems into mathematical models
4. To find a solution to the problem in different cases
5. To inculcate logical thinking to find a solution to problem.

UNIT-I

Introduction of OR – Origin and development of OR – Nature and features (Characteristics) of OR –Scientific Method in OR – Modeling in OR – Advantages and limitations of Models-General Solution methods of OR models – Applications of Operation Research.

UNIT-II

Linear programming problem (LPP) -Mathematical formulation of the problem - illustrations on Mathematical formulation of Linear programming of problem. Graphical solution of linear programming problems with maximizing and minimizing objective function up to 3 variables

UNIT-III

Simplex Method – Solution- Feasible Optimum solutions – Basic feasible solution – Non-Degenerate, Degenerate and un bounded solutions- Canonical or Standard form of LPP – Characteristics - Slack and Surplus variable - Simplex Algorithm - Problems

UNIT-IV

Artificial variable technique- Big-M method – Steps involved for getting optimum solution - Two-phase simplex method -Steps involved for getting optimum solution - problems

UNIT-V

Simulation: Definition, Types of simulation, Random variable, Random number, Pseudo-random numbers, Monte-Carlo Technique, Generation of random numbers and problems.

Reference Books:

1. S.D. Sharma, Operations Research, KedarNath Ram Nath& Co, Meerut.
2. KantiSwarup, P.K.Gupta, Manmohn, Operations Research, Sultan Chand and sons, New Delhi.
3. J.K. Sharma, Operations Research and Application, Mc.Millan and Company, New Delhi.
4. Gass: Linear Programming. Mc Graw Hill.
5. Hadly :Linear programming. Addison-Wesley.
6. Taha : Operations Research: An Introduction : Mac Millan.

Practical/Lab to be performed on a computer using OR/Statistical packages

1. Formulation of LPP
2. Graphical Method for maximization
3. Graphical Method for minimization
4. Graphical Method for Unbounded Solution
5. Simplex method for maximization
6. Simplex method for minimization
7. Big M- Method
8. Two – Phase Simplex method .
9. Monte -carlo method.

Semester-wise Revised Syllabus under CBCS w.e.f 2020-21

Course 7A: OPERATION RESEARCH - II
(Skill Enhancement Course(Elective), 05 Credits
Max.Marks: Theory :100 + Practicals: 50

Objective: To enrich the knowledge of students with advance techniques of linear programming problem along with real life applications

Learning Outcomes:

After learning this course, the student will be able

1. To solve the problem in logistics
2. To find a solution for the problems having space constraints
3. To minimize the total elapsed time in a industry by efficient allocation of jobs to the suitable persons
4. To find a solution for an adequate usage of human resources
5. To find the most plausible solutions industries and agriculture when a random environment exists.

UNIT -I

Transportation problem - Introduction, Mathematical formulation of Transportation problem, Tabular representation, Definitions, Initial Basic feasible solution of Transportation problem- North-west corner rule, Lowest cost entry method, Vogel's approximation method. Method of finding optimal solution- Modi method(U-V method). Unbalanced transportation problem. Maximization Transportation problem

UNIT-II

Assignment problem - Introduction, Mathematical formulation of Assignment problem, Reduction theorem(statement only), Hungarian Method for solving Assignment problem, Unbalanced Assignment problem. Traveling salesman problem

UNIT-III

Sequencing problem: Introduction, assumptions of sequencing problem, Johnson's algorithm for n jobs on two machines problem- problems with n-jobs on two machines, algorithm for n jobs on three machines problem- problems with n- jobs on three machines, algorithm for n jobs on k machines, problems with n-jobs on k-machines.

UNIT-IV

Network Scheduling -Basic components of a network - nodes and arcs – events and activities - Rules of Network construction- Time calculation in networks - Critical path method(CPM) and PERT.

UNIT –V

Game Theory - Two- person zero-sum game. Pure and Mixed strategies. Maxmin and Minmax Principles - Saddle point and its existence - Games without saddle point- Mixed strategies- Solution of 2x2 rectangular games -Graphical method for solving 2xn and mx2 games - Dominance property –Solution of game by Dominance method

Reference Books:

1. S.D. Sharma, Operations Research, KedarNath Ram Nath& Co, Meerut.
2. KantiSwarup, P.K.Gupta, Manmohn, Operations Research, Sultan Chand and sons, New Delhi.
3. J.K. Sharma, Operations Research and Application, Mc.Millan and Company, New Delhi.
4. Gass: Linear Programming. Mc Graw Hill.
5. Hadly :Linear programming. Addison-Wesley.
6. Taha : Operations Research: An Introduction : Mac Millan.

Practical/Lab to be performed on a computer using OR/Statistical packages

1. IBFS of Transportation problem by using North- West corner rule
2. IBFS of Transportation problem by using Matrix minimum method
3. IBFS of Transportation problem by using VAM
4. Solution of Assignment problem using Hungarian method
5. Traveling salesman problem
6. Solution of sequencing problem—processing of n jobs through two machines
7. Solution of sequencing problem - processing of n jobs through three machines
8. To perform Project scheduling of a given project (Deterministic case-CPM).
9. To perform Project scheduling of a given project (Probabilistic case-PERT).
10. Solution of m x n games by dominance rule