

Discipline Specific Elective
Category-V
Discipline Specific Elective for B. Sc. (H) Statistics

**DISCIPLINE SPECIFIC ELECTIVE COURSE-1A: Optimization
Techniques**

**CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE
COURSE**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Operational Research	4	3	0	1	Passed Class XII with Mathematics	Nil

Learning Objectives:

The learning objectives include:

- To create awareness about the term operational research (OR) and acquaint them with the methodologies, scope, limitations and applications of OR and
- To expose the students with the knowledge of formulation of real life problems using the linear programming method.
- To make the students understand about the theory and practical application of transportation problems and assignment problems
- To introduce ‘Game Theory-the science of strategy’ to the students, which makes possible the analysis of the decision making process of interdependent subjects.
- To provide a framework to develop mathematical models for different types inventory systems.

Learning Outcomes:

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

- Understand the fundamental concepts of Operational Research Techniques
- Apply Linear Programming.
- Solve the Transportation and assignment problems
- Understand the Game Theory
- Use the Inventory Models

SYLLABUS OF DSE-1A

Theory

UNIT I

(15 hours)

Introduction to OR and LPP

Definition and phases of O.R. Model building, various types of O.R. problems. Linear Programming Problem (L.P.P.): Mathematical formulation of the L.P.P, graphical solutions of L.P.P. Simplex method for solving L.P.P. Charne's M-technique for solving L.P.P. involving artificial variables. Special cases of L.P.P. Concept of Duality in L.P.P. Economic interpretation of Duality. Dual simplex method.

UNIT II

(15 hours)

Transportation and Assignment Problem

Transportation Problem: Initial solution by North West corner rule, Least cost method and Vogel's approximation method (VAM), MODI's method to find the optimal solution, special cases of transportation problem. Assignment problem: Hungarian method to find optimal assignment, special cases of assignment problem.

UNIT III

(15 hours)

Game Theory and Inventory Management

Game theory: Rectangular game, minimax - maximin principle, solution to rectangular game using graphical method, dominance and modified dominance property to reduce the game matrix and solution to rectangular game with mixed strategy. Network flow problems and shortest route problem. Inventory Management: *ABC* inventory system, characteristics of inventory system. EOQ Model and its variations, with and without shortages.

PRACTICAL/LAB WORK – (30 hours)

List of Practical:

1. Mathematical formulation of L.P.P and solving the problem using graphical method.
2. Simplex technique and Charne's Big M method involving artificial variables.
3. Identifying Special cases by Graphical and Simplex method and interpretation:
 - a) Degenerate solution
 - b) Unbounded solution
 - c) Alternate solution
 - d) Infeasible solution
4. Allocation problem using Transportation model.
5. Allocation problem using Assignment model.
6. Graphical solution to $m \times n$ rectangular game
7. Mixed strategy
8. To find optimal inventory policy for EOQ models and its variations.

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators/ TORA/WINQSB/LINGO

ESSENTIAL READINGS:

- Swarup, K., Gupta, P.K. and Man Mohan (2013). Operations Research, 16th Ed., Sultan Chand and Sons.
- Taha, H. A. (2007). Operations Research: An Introduction, 8thEd., Prentice Hall of India.

SUGGESTIVE READINGS:

- F.S. Hillier. G.J. Lieberman (2010). Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata McGraw Hill.
- Donald Waters (2010): Inventory Control and Management, John Wiley.
- A. Ravindran, D. T. Phillips and James J. Solberg(2005). Operations Research- Principles and Practice, John Wiley & Sons,
- G. Hadley (2002). Linear Programming, Reprint.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVE COURSE – 1B: PSYCHOLOGICAL AND EDUCATIONAL STATISTICS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Psychological and Educational Statistics	4	3	0	1	Passed Class XII with Mathematics	Theory of Probability Distributions

Learning Objectives:

The learning objectives include:

- To measure psychological traits and mental abilities
- To learn basic methods of test construction, item writing and item analysis
- To check the reliability and validity of test scores.

Learning Outcomes:

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

- Distinguish between Psychological measurement and physical measurement.
- Understand the meaning of Tests in Psychology and Education.
- Appreciate the uses and limitations of Psychological tests.
- Learn the meaning and purpose of Item writing and analysis.
- Understand concepts of reliability and validity of test scores and their differences.
- Convert raw scores into different transformed scores.
- Apply Scaling rankings and ratings in terms of the Normal Probability Curve.

SYLLABUS OF DSE-1B

Theory

Unit I

(15 hours)

Basics of Educational Statistics

Introduction; need and importance of statistics in psychology and education. Measurements: Levels of measurements. Distinction between psychological and physical measurements; general problems, sources of errors. Tests: Meaning of tests in psychology and education; history of psychological measurement and testing, uses, limitations and varieties, characteristics of a good test, general steps of test construction. Test administration. Item writing - Meaning and types; Item analysis – meaning and purpose. Item difficulty (concepts only). Power tests and speed tests.

Unit II

(15 hours)

Reliability and Validity

Reliability: Meaning, methods (or types); standard error of measurement, reliability of speed test, factors influencing reliability of test scores, factors for their improvement, estimation of true scores and index of reliability. Reliability of difference and composite scores. Validity:

Meaning; content, criterion related and construct validity. Statistical methods for calculating validity, factors influencing validity. Extra validity concerns, relation of validity to reliability.

Unit III

(15 hours)

Psychological Statistics

Meaning of norm referencing and criterion referencing. Raw score transformations- percentile score, standard scores, normalized standard scores, T-scores, C-scores and Stanine scores. Intelligence: Definition. Types of intelligence test scores. Spearman's two-factor theory and Thomson group factors theory. Psychological scaling methods – Scaling of Individual test items in terms of difficulty, scaling of rankings & ratings in terms of the normal probability curve.

PRACTICAL/LAB WORK - 30 hours

List of Practical:

1. Computation of Reliability by Rulon and Kuder Richardson Formulas.
2. Finding reliability of a test whose length is increased/ decreased n times.
3. Finding index of reliability, standard error of measurement.
4. Finding validity/maximum validity when test length is increased n times/ indefinitely.
5. Finding relative difficulty of questions/ difference in difficulty between different tests.
6. Converting raw scores into Z-scores.
7. Converting raw scores into T-scores.
8. Calculation of T scores for a given frequency distribution.
9. Construction of C-scales and its diagrammatic representation.
10. Construction of Stanine-scales and its diagrammatic representation.
11. Calculation of percentile scores corresponding to rank of an individual among N individuals.
12. Finding numerical scores corresponding to grades or ratings by different judges.

Practical work to be conducted using electronic spreadsheet / EXCEL/ Statistical Software Package/ SPSS/ calculators.

ESSENTIAL READINGS:

- Garrett H. E. (2021). Statistics in psychology and education. Nation Press.
- Gregory R. J. (2016). Psychological testing: History Principles and Applications. (Updated seventh). Pearson.
- Singh, A. K. (2006). Tests, Measurements and Research in Behavioural Sciences. Bharati Bhavan.
- Anastasi A. & Urbina S. (1997). Psychological testing (7th ed.). Prentice Hall.

SUGGESTIVE READINGS:

- Gupta, S. C., & Kapoor, V. K. (2019). Fundamentals of applied statistics. Sultan Chand & Sons.
- Goon A M, Gupta M K and Dasgupta B (2018): Fundamentals of Statistics, Volume II, 9th Edition and 4th reprint.
- Mangal, S. K. (2016). Statistics in Psychology and Education. PHI Learning Pvt. Ltd..

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