ParvathaneniBrahmayya
Siddhartha College of Arts & Science, Vijayawada

Course Code: **STASET01**
Offered to: Offered to: **B.A(EMS)/B.Sc. (M.S.Cs., Ca.M.S., M.S.Ds)**
Domain Subject: STATISTICS   Semester – **V**
Max. Marks: **100** (CCIA: 25+ SEE:75)   Theory Hrs./Week: **3**

Title of the paper: OPERATIONS RESEARCH-I

Type of the Course: **Skill Enhancement Course** (Elective Theory),   Credits: **04**

Course Outcomes: Students at the successful completion of the course will be able to:

CO1: Develop the basic knowledge in Operation research (O.R.,) and describe the Nature, Scientific methods and Decision making (O.R.,)able to understand the application of OR and frame a Linear Programming Problem (LPP) with solution using graphical methodology.(PO-5)
CO2: Knowledge to minimize or maximize the objective function value of LPP using simplex method.(PO-5)
CO3: know to solve the LPP by using Big- method and Two phase methods(PO-6)
CO4: To solve the problems in logistics (PO-5)
CO5: To minimize the total elapsed time in an industry by efficient allocation of jobs to the suitable persons. (PO-6)

Syllabus
(Total Theory Hours: 45)
UNIT-I (9 Periods)
Operations Research - An overview
Origin, Nature and features of O.R. Advantages and limitations of models, General solution methods for O.R. models, Applications.
Linear Programming Problem – Mathematical formulation and graphical solution
Definition, components, basic assumptions, Mathematical formulation of the problem, Illustrations on mathematical formulation of L.P.P. (two and three variables) L.P.P - graphical solution method (search approach method).solution and infeasible solution

UNIT-II (9Periods)
Linear Programming Problem-Simplex Method-I
General LPP-Objective function, constraints, non-negative restrictions, Solution of LPP, feasible solution and optimum solution, Canonical and Standard forms of LPP. Basic solution-definition, degenerate solution, basic feasible solution. Associated cost vector, improved basic feasible solution, optimum basic feasible solution and net evaluation. The computational procedure- Simplex Algorithm. Simple linear programming problems on 2 and 3 variables using Simplex Method

UNIT-III (9 Periods)
Linear Programming Problem-Simplex Method-II
Artificial Variable Technique (2 and 3 variables only).The Big *M* Method or Method of Penalties. The Two-phase Simplex Method. Special cases in simplex method (2 and 3 variables only) – Degeneracy, Alternative optima, Unbounded solutions and Non existing or infeasible solutions

UNIT-IV (9 Periods)

Transportation Problem- Introduction, Mathematical formulation of Transportation problem. Definition of 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). Degeneracy in transportation problem, Resolution of degeneracy, Unbalanced transportation problem. Maximization TP.Transshipment Problem.

UNIT-V (9 Periods)

Assignment Problem -Introduction, Mathematical formulation of Assignment problem, Reduction theorem (statement only), Hungarian Method for solving Assignment problem, Unbalanced Assignment problem. The Traveling salesman problem, Formulation of Traveling salesman problem as an Assignment problem and Solution procedure.

Text Book:
1. KantiSwarup, P.K.Gupta , Man Mohan,Operations Research, 15th Edition, 2010, Sultan Chand & Sons, New Delhi.

List of Reference Books:
1. Quality,Reliability& Operations Research, First Edition (2010), Published by Telugu Akademi,Hyderabad.
2. Operations Research Theory, Methods and Applications, S.D. Sharma, Himanshu Sharma, improved and enlarged edition, KedarNathRamNath& Co., Meerut.
3. Kirshna's Operations Research, Dr. R. K. Gupta, 27 thEdition , 2010, Krishna Prakashan Media (P) Ltd., Meerut.
4. Operations Research: Theory and Applications, J.K.Sharma, 5th Edition, 2013, Macmillan.
5. Operations Research: An Introduction, Hamdy. A. Taha, 9th edition ,2010, Prentice Hall.

Co-Curricular Activities

(a) Mandatory: (Training of students by teacher in field related skills:
(lab:10 + field: 05)

For Teacher: Training of students by the teacher (if necessary, by a local expert) in laboratory/field for a total of not less than 15 hours on the field techniques/skills on the familiarization of various operating systems and program softwares.

For Student: Students shall (individually) operating the computers and execution of their programmes for data analysis

Student shall write the observations and submit a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.
1. Max marks for Fieldwork/Project work: 10.
2. Suggested Format for Fieldwork/Project work: Title page, student details,
3. index page, details of place visited, observations, findings and acknowledgements.
4. Comprehensive Continuous Internal Assessment (CCIA): (2 tests will be conducted, each carries 30 Marks, consider Average Mark: 15)

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Model paper

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OPERATIONS RESEARCH-I
SECTION A

Answer any FIVE questions.   **5 X5M = 25M**

1. What are the characteristics of a good model for O.R? .(CO-1,L-1)
2. What are the advantages and disadvantages of operational research model. .(CO-1,L-1)
3. Explain graphical procedure in solving linear programming problems. .(CO-1,L-2)
4. Explain the slack variables and surplus variables. .(CO-2,L-2)
5. Explain about transportation problem. .(CO-4,L-2)
6. Explain mathematical formulation of assignment problem.(CO-5,L-2)
7. Explain i) north- west corner   ii) least cost methods.(CO-4,L-4)
8. Explain balance and unbalance transportation method. .(CO-4,L-4)

SECTION B

Solve any FIVE problems.   **5 X 10M =50M**

9. (a) Explain the various phases in solving an OR problem. .(CO-1,L-4)

   (OR)

   (b)Use the graphical method to solve the following L.P.P.(CO-1,L-4)

   $Min\ Z = 1.5x_1 + 2.5x_2$

   Subject to conditions

   $x_1 + 3x_2 \geq 3$

   $x_1 + x_2 \geq 2$

   and $x_1, x_2 \geq 0.$

10. (a) Using simple method to .(CO-2,L-3)

    Minimum z = x2 - 3x3 + 2x5

    subject to the constraints:

    $3x_2 - x_3 + 2x_5 \leq 7,$

    $-2x_2 + 4x_3 \leq 12,$

    $-4x_2 + 3x_3 + 8x_5 \leq 10,$

    $x_2, x_3, x_5 \geq 0$

    (OR)

    (b) Using simplex method to .(CO-2,L-3)

    Maximize $Z = 2x_1 + 4x_2 + x_3 + x_4$

    Subject to the constraints

    $x_1 + 3x_2 + x_4 \leq 4,$

    $2x_1 + x_2 \leq 3,$

    $x_2 + 4x_3 + x_4 \leq 3,$

    $x_1, x_2, x_3, x_4 \geq 0$

11. (a) Solve the following LPP by penalty (BIG-M) .(CO-3,L-3)

    Maximize $Z = 3x_1 - x_2$

    Subject to the constraints

$$2x_1 + x_2 \geq 2$$
$$x_1 + 3x_2 \leq 3$$
$$x_2 \leq 4$$
$$x_1, x_2 \geq 0$$

(OR)

(b) Use Two - phase simplex method to Maximize $Z = 5x_1 + 2x_2 - 3x_3$.(CO-3,L-3)

Subject to the constraints:
$$2x_1 + 2x_2 - x_3 \geq 2,$$
$$3x_1 - 4x_2 \leq 3,$$
$$x_2 + 3x_3 \leq 5,$$
$$x_1, x_2, x_3 \geq 0$$

12. (a) Solve the following transportation problem in which cell entries represent unit costs .(CO-4,L-3)

	DI	DII	D III	Availability
A	2	7	4	5
B	3	3	1	8
C	5	4	7	7
D	1	6	2	14
Requirement	7	9	18	

(OR)

(b) Determine the optimum basic feasible solution to the following transportation Problem .(CO-4,L-3)

	A	B	C	Availability
A	50	30	220	1
B	90	45	170	3
C	250	200	50	4
Requirement	4	2	2	

13. (a) a department head has four subordinates, and four tasks have to be performed. Subordinates differ in efficiency and tstks differ in their intrinsic difficulty. Time each man would take to perform each task is given in effectiveness matrix. How the task should be allotted to each person so as to minimize the total man-hours? (CO-5,L-3)

	Subordinates			
	I	II	III	IV
A	8	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

(OR)

(b) A certain equipment needs five repair jobs which have to be assigned to five machines. The estimated time (in hours) that each machine requires to complete the repair job is given in the following table .(CO-5,L-3)

MAN\ JOB	I	II	III	IV	V
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

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Domain Subject: **STATISTICS**   Semester: **V**
Max. Marks: **50** (CCIA: 10+ SEE: 40)   Practical Hrs./Week **: 3**

Practical No	Theme	Key Topics
SPSS TECHNIQUES		
1	Univariate Analysis of data (categorical variable)	Data Entry, Frequency table, Chart Builder – Bar Chart and Pie Chart
2	Univariate Analysis of data (Continuous variable)	Data Entry, Frequency table, Descriptive, Exploratory, Chart Builder - Histogram, Box Plots, Cluster Bar, Stacked Bar, Editing graphs and axes
3	Bivariate Analysis of Data	Data Entry, Descriptive, Relation between variable through Scatter diagram and correlation coefficient. Linear Regression.
4	Bivariate Analysis of Data (Categorical Variables)	Data Entry, Frequency table, Cross Table, Spearman Correlation, Association between variables
OPERATION RESEARCH TECHNIQUES		
5	Linear Programming Problem – I	Simplex Method – Minimization and Maximization with all constraints are less than or equal to type
6	Linear Programming Problem – II	Big - M and Two Phase Methods
7	Transportation problem	Minimization and Maximization
8	Assignment problem	Minimization and Maximization

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