Department of Liberal Education
Era University, Lucknow
Course Outline
Effective From: 2023-24

Name of the Program	B.A. / B.Sc. (LIBERAL EDUCATION)			Year/ Semester:		3rd / 5th
Course Name	Operations Research	Course Code:	ST301	Type:		Theory
Credits	03			Total Sessions Hours:		45 Hours
Evaluation Spread	Internal Continuous Assessment:	40 Marks		End Term Exam:		35 Marks
Type of Course	○ Compulsory		⊙ Core	○ Creative		○ Life Skill
Course Objectives	1. Understand the historical background and principles of Operations Research (OR) and its applications in real-world problem-solving. 2. Apply various mathematical techniques such as linear programming, transportation, assignment, replacement, job sequencing, and game theory to model and solve optimization problems. 3. Develop proficiency in formulating linear programming problems and applying graphical, simplex, Big-M, and two-phase methods to find optimal solutions. 4. Solve transportation problems using methods like the North-west corner rule, Least Cost method, and Vogel's approximation method, and solve assignment problems using the Hungarian Method. **5.** Analyze and solve replacement problems, job sequencing problems, and rectangular games, including the minimax-maximin principle, dominance property, and mixed strategy solutions.					

Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*

Course Outcome (CO)	Attributes
CO1	Gain a comprehensive understanding of Operations Research (OR) and its historical background. Acquire the ability to formulate and solve general linear programming problems using different methods. Understand and handle degeneracy and duality in linear programming problems.
CO2	Develop proficiency in solving transportation problems using. Acquire the skills to determine the optimum solution using the Modified Distribution method. Apply the Hungarian Method to solve assignment problems and gain familiarity with the Travelling Salesman Problem.
CO3	Gain the ability to analyze and solve replacement problems involving individual and group replacements. Develop proficiency in solving job sequencing problems with various configurations, including n jobs - 2 machines, n jobs - k machines, and 2 jobs - n machines.
CO4	Understand the fundamentals of game theory and its applications in competitive situations. Analyze and solve rectangular games and Two-Person Zero-Sum games using techniques such as the minimax-maximin principle and graphical method. Acquire the skills to utilize the dominance property to reduce game matrices and solve rectangular games with mixed strategies.
Pedagogy	Interactive, discussion-bases, student-centered, presentation.

Internal Evaluation Mode	Mid-term Examination: 20 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks		
Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	History & background of OR, General linear programming problems and their formulations. Solving LPP by Graphical Method. Solving LPP by, Simplex method, Big–M method, Two-phase Method, Duality in LPP.	12	CO1
Unit 2	Transportation problem: North-west corner rule, Least cost method, Vogel's approximation method. Optimum solution: Modified Distribution method. Assignment Problem: Hungarian Method, Travelling Salesman Problem.	10	CO2
Unit 3	Replacement problem: Individual and Group replacement. Job sequencing: n jobs – 2 machines, n jobs – k machines, 2 jobs – n machines.	12	CO3
Unit 4	Game theory: Introduction, Games. Two-Person Zero-Sum game, minimax-maximin principle, Solution to TPZS game using graphical method. Dominance property to reduce the game matrix and solution to TPZS game with mixed strategy, LPP method.	11	CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1			3	3		2			1	3	2	3		
CO2			3	3		1			1	2	3	3		
CO3			3	3		2			1	3	2	3		
CO4			3	3		1			1	3	3	3		

Strong contribution-3,   Average contribution-2 ,   Low contribution-1,

Suggested Readings:

Text- Books	1. Swarup, K., Gupta P.K. and ManMohan (2007). Operations Research (13th ed.), Sultan Chand & Sons. 2. Taha, H.A. (2007). Operations Research: An Introduction (8th ed.), Prentice Hall of India
Reference Books	1. Hillier, F.A and Lieberman, G.J. (2010): Introduction to Operations Research-Concepts and cases, 9th Edition, Tata McGraw Hill 2. Hadley, G: (2002) : Linear Programming, Narosa Publications.

Para Text	Unit 1:
	    1. https://www.youtube.com/watch?v=6v2CPw0tkgc
	    2. https://www.youtube.com/watch?v=cH-eKpkOETo
	    3. https://www.youtube.com/watch?v=Yzf37Fkm3Zw
	Unit 2:
	    1. https://www.youtube.com/watch?v=KfEkvh5CnQk
	    2. https://www.youtube.com/watch?v=p4ktv64FtN4
	    3. https://www.youtube.com/watch?v=HXFWK1GJw-A
	Unit 3:
	    1. https://www.youtube.com/watch?v=5STnUAtEHIY
	    2. https://www.youtube.com/watch?v=Dc2KXG8CV3w
	Unit 4:
	    1. https://www.youtube.com/watch?v=9L2lDnNp0vs
	    2. https://www.youtube.com/watch?v=9B9Xi2c9vfQ

	3.	https://www.youtube.com/watch?v=jCjPxa0f_Gc

Recapitulation & Examination Pattern

Internal Continuous Assessment:

Component	Marks	Pattern
Mid Semester	20	**Section A:** Contains **10** MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries **0.5 mark.** **Section B:** Contains **07** descriptive questions out of which **05** questions are to be attempted. Each question carries **03 marks**.
Class Test	05	Contains **05 descriptive questions.** Each question carries **01** mark.
Online Test/ Objective Test	05	Contains **10 multiple choice questions.** Each question carries **0.5** mark.
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher
Attendance	05	As per policy
Total Marks	**40**	

Course created by: **Dr. Abdul Quddoos** **Dr. Nazia Naqvi** **Signature:**	**Approved by: Prof. Shashi Bhushan** *Shashi Bhushan* **Signature:**