Course Code				22ANL 301			
Title of the Course				**Operations Research**			
Offered to:				**MBA Business Analytics**			
L	**5**	**T**	**0**	**P**	**0**	**C**	**4**
Year of Introduction:		**2024-25**		Semester:			3
Course Category:		Core		**Course Relates to:**		Global	
Year of Revision:		NA		Percentage:		NA	
Type of the Course: Value Added				**Skill Development**			
Crosscutting Issues of the Course:				NA			
Pre-requisites, if any				**Database Management**			

Course Description: Operations Research is the application of analytical methods to aid decision-making. This course covers optimization, stochastic models, and simulation techniques. It equips students with mathematical tools to solve complex problems in logistics, finance, and manufacturing, emphasizing practical applications in resource allocation, scheduling, and risk management within organizational systems.

Course Aims and Objectives:

1. Understand the methodology of OR problem solving and formulate linear programming problem.
2. Develop formulation skills in transportation models assignment models and network models finding solutions
3. Understand the basics in the field of game theory and decision theory.
4. Know the basics of Queueing theory and programming and simulation.

Course Outcomes

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Imparts skills in the use of OR Models and Phases in decision making problems in industry	K1	PO1	1
CO2	Provide students with knowledge of formulating mathematical model for quantitative analysis of managerial problems in industry.	K2	PO2	2
CO3	Develop the ability to identify network transportation and assignment models in solving real business problems.	K3	PO3	1
CO4	Understand the significance of game theory and decision theory models for facilitates the managerial decision-making.	K3	PO3, PO1	2
CO5	Enable the students understand the queuing and simulation concepts that yield a competitive advantage through operational excellence.	K5	PO7	2

CO-PO MATRIX									
CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	2						3	2
CO2							3	2	3
CO3	3	2						3	2
CO4			3				2	2	3
CO5	3	2						3	2

Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

Course Content

Unit I : Operations Research: Nature and features of OR , Introduction, Uses, Scope, and Applications of Operation Research in Managerial Decision-making - O.R. Models - phases of OR- Formulation of Models - Using Models for Problem Solving-Techniques of Operations Research - Limitations of Operations Research.   **(12 Hours)**

Unit II: Linear Programming and Duality
Linear programming, Mathematical Formulations of LP Models for Product-mix Problems-Graphical Method-Simplex Method and its Applications**.**
Duality and Network Techniques: Duality in Linear Programming - Technical Issues in Simplex Method - **(18 Hours)**

Unit III: Transportation & Assignment Problem: Transportation-Introduction - Methods for Finding Initial Solution - Optimum Solution-MODI Method - Assignment Problem- Introduction-Hungarian Method. Project Management - Network Models: PERT, and CPM and its Applications**.**
(18 Hours)

Unit IV : Game Theory & Decision Theory: - Introduction - Two Person Zero sum games - Pure and Mixed Strategies - Dominance Principles - Graphical method - Decision Theory and its Applications. **(15Hours)**

Unit V
Queuing Theory &Simulation: Queuing model (M / M I : ∞ / FCFS ONLY): Components, Basic Structure, and Assumptions - waiting line Decision Problem - Simulation: Types, Random variable, Monte-Carlo Technique. **(12 Hours)**

Reference Books:

1. S.D.Sharma., Operation Research Theory, Methods & Applications, 17th Revised Edition,(2014) KedarNathRamnath, New Delhi.

2. Kantiswarup, P.K.Gupta and Manmohan, Operations Research, 15th Edition (2010) Sultan Chand & Sons New Delhi.

3. Kapoor, V.K., Operation Research Techniques for Management, 4th Edition, (2001), Sultan Chand & Sons, New Delhi.

4. Sharma, J. K., Operation Research - Theory and Applications, 5th Edition (2013) MacMillan.

5. R. Paneerselvam, Operation Research – 2nd Edition,(2009) PHI learning private ltd.,

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MODEL QUESTION PAPER

M.B.A. (Business Analytics) EXAMINATION
22ANL301: OPERATIONS RESEARCH

Time: Three hours   **Maximum Marks: 70**

SECTION A – (5X4 = 20 Marks)

1. a) Explain the Scope of O.R. (CO1) (K2)

        (OR)

    b) Explain the nature of OR (CO1) (K2)

2. a) Explain Slack and Surplus variables (CO2)(K2)

            (OR)

    b) Discuss about Duality in L.P (CO3)(K2)

3. a) write a short note on Unbalanced Assignment Problem (CO 3) (K2)

            (OR)

    b) Explain the concept of Unbalanced Transportation Problem (CO3)(K2)

4. a) what do you mean Pure and Mixed Strategy(CO 4)(K2)

            (OR)

    b) write about Decision Theory (CO 4)(K2)

5. a) write a short note on Characteristics of a queuing system (CO5)(K2)

            (OR)

    b) Explain the concept of Simulation (CO5)(K2)

SECTION- B

Answer All Questions.   **(5X8 = 40 Marks)**

6. a) write the applications of OR and its importance. (CO1 , K1)

                                Or

6b) outline the models of OR and phases of OR (CO1 , K1)

7)   a) Solve the following problem by using Big M method (CO 1)(K3)

Maximize $Z = 3x_1 + 2x_2 + 3x_3$

Subject to constraints:

$2x_1 + 3x_2 >= 24$

$3x_1 + x_2 >= 12$

$2x_1 + 2x_2 >= 16$, and $x_1, x_2 >= 0$.

                                OR

7. b) One unit of A contributes Rs. 7 as profit and requires 3 units of Raw material and 2 hours of labour. One unit of product B contributes Rs. 5 as profit and requires 2 units of raw material and one hour labour. Availability of raw material at present is 45 units and that of labour as 40 hours. Formulate it as linear programming problem and write its dual.(CO 2)(K3)

8.a) Solve the following transportation problem starting with the initial solution obtained by VAM(CO 3)(K3)

	D1	D2	D3	D4	Supply
O1	2	2	2	1	3
O2	10	8	5	4	7
O3	7	6	6	8	5
Required	4	3	4	4	

Or

8. b) A company has 4 machines to do 3 jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given below. Determine the job assignments which will minimize the total cost.(CO 3)(K5)

	M1	M2	M3	M4
Job 1	18	24	28	82
Job 2	8	18	17	18
Job 3	10	15	19	22

9.a) Solve the following game using principle of dominance principle (CO 4)(K3)

		PLAYER B					
	A/B	B1	B2	B3	B4	B5	B6
	A1	4	2	0	2	1	1
	A2	4	3	1	3	2	2
PLAYER A	A3	4	3	7	-5	1	2
	A4	4	3	4	-1	2	2
	A5	4	3	3	-2	2	2

Or

9.b) A and B play a game in which each has three coins, a 5 paise, a 10 paise and a 20 paise.

Each selects a coin without the knowledge of the others choice. If the sum of the coins thus elected by them is an odd amount, A wins B's coin. If the sum is even B wins A's coin. Find the best strategy for each player and the value of the game. (CO 4)(K1).

10. (a)A TV repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they come in, and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day, what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?(CO 4)(K1)

Or

(b) What is simulation? Discuss the advantages and limitations of Simulation.(CO 5)(K1)

SECTION C – (Compulsory)   **1X10 = 10 Marks**

11. Construct the Network for the following Project and determine the following :(CO 2)(L3)

(i) Critical Path

(ii) Earliest Slack, Earliest Finish, Latest Slack, Latest Finish

(iii) Total Float, Free Float.

Activity	1-2	2-3	2-4	3-5	3-6	4-6	4-7	5-8	6-8	7-8
Duration	2	3	5	4	1	6	2	8	7	4

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