THAKUR INSTITUTE OF
MANAGEMENT STUDIES & RESEARCH
(Approved by AICTE, Govt. of Maharashtra & Affiliated to University of Mumbai)
• ISO 9001 : 2015 Certified

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Mapping of Course Outcomes with Question Papers

Academic Year	2021-22
Batch	2020-22
Program	MMS
Specialization	FMHO
Semester	II
Course	**Operations Research**
Faculty	Prof. Navin Bhatt

CO1: Recognize the importance and value of Operations Research and mathematical modelling in solving practical problems in industry

CO2: Formulate a managerial decision problem into a mathematical model

CO3: Identify OR models and apply them to real-life problems

CO4: Able to design new simple models, like: CPM, PERT to improve decision making and develop critical thinking and objectives analysis of decision problems

Question Number	CO 1	CO 2	CO 3	CO 4	CO 5
Q1	*	*	*	*	
Q2. a	*	*	*	*	
Q2. b	*	*	*	*	
Q3.	*	*	*	*	
Q4. a	*	*	*	*	
Q4. b	*				
Q5. a	*	*	*	*	
Q5. b	*				
Q6. a	*	*	*	*	
Q6. b	*				

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	Course Outcomes:-
CO1	1. Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry
CO2	2. Formulate a managerial decision problem into a mathematical model
CO3	3. Identify OR models and apply them to real-life problems
CO4	4. Able to design new simple models to improve decision making and develop critical thinking and objectives analysis of decision problems

	Instructions:-
1	Question no. 1 is compulsory
2	Attempt any three out of remaining five questions

	Answer the following questions:-	Marks
1	In a factory there are 4 machines and 4 jobs are to be done on one to one basis. The manager assess the profit for each jobs as given below:	10 marks
Q2 a)	A company has three facilities which extracts limestone from its three field sites which is then transported to four demand centres. The fields are F1 (yield of 7 metric ton), F2 (yield of 9 metric ton) and F3 (yield of 18 metric ton) with demand centres D1 (requirement of 5 metric ton), D2 (requirement of 8 metric ton), D3 (requirement of 7 metric ton) and D4 (requirement of 14 metric ton). The associated transporation cost per metric ton are given below in the table. Calculate a) Initial Feasible Solution using VAM, b) Is the solution degenerate?	6 marks
Q 2 b)	In a co – operative bank, cheques are cashed at a single teller counter. Customers arrive at a counter in a Poisson manner at an average rate of 30 customers per hour. The teller takes on an average 1.5 minute to cash a cheque. The service time	4 marks

For Question 1:

		Machines			
		A	**B**	**C**	**D**
Jobs	**I**	42	35	28	21
	II	30	25	20	15
	III	30	25	20	15
	IV	24	20	16	12

Assign the jobs to the machines so as to maximize the profit

For Question Q2 a):

	D1	**D2**	**D3**	**D4**
F1	19	30	50	10
F2	70	30	40	60
F3	40	8	70	20

	is exponentially distributed. A) Calculate the percentage of time the teller is busy and percentage of time the teller is idle. B) Calculate the average time a customer is expected to wait.	
Q 3	Reduce the following game by dominance property and find optimal strategy & value of the game	10 marks

		Player B					
		I	**II**	**III**	**IV**	**V**	**VI**
	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
Player A	**3**	4	3	7	-5	1	2
	4	4	3	4	-1	2	2
	5	4	3	3	-2	2	2

Q 4 a	A retailer has option of keeping stock of 15, 16, 17 or 18 units. Only one stock level can be maintained. Demand in the market can vary. It can be 15, 16 , 17 or 18 units. Probabilities associated with demand levels are 0.1, 0.2, 0.4 and 0.3 respectively. Cost per unit for retailer is Rs. 5 and selling price is Rs. 8 per unit. Unsold quantity can be sold as scrap at Rs. 2 per unit. Find EMV and recommend optimal decision.	6 marks
Q4 b	Explain minimax regret criterion and Laplace criterion of decision making.	4 marks
Q 5 a	Furniture World Ltd. produces two products chair and table, with the help pf machinery and labours. To produce one unit of chair 20 machine hours and 5 labour hours are required. To produce one unit of table 10 machine hours and 50 labour hours are required. Maximum 500 machine hours and 300 labour hours can be utilized for production. Profit per unit of chair is Rs. 50 and table is Rs. 20. Formulate LPP and solve the problem by simplex method.	6 marks
Q 5 b	Write short notes on – a) Decision Tree b) Duality in LPP	4 marks
Q 6 a	ABC motorcycles Ltd manufactures around 200 motorcycles. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 motocycles to 204 motorcycles, whose probability distribution is as given below –	6 marks

Production per day	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

	The finished motocycles are transported in a specially designed three – storeyed truck that can accommodate only 200 motocycles. Using the following 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54 and 10, simulate (for 15 days) the process to find out a) what will be the average number of motorcycles waiting in the factory? b) what will be number of empty spaces in the truck?	
Q 6 b	What are the different environments in which decisions are made?	4 marks