Q. Code:923714

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth-Semester

MN22403 – OPERATIONS RESEARCH AND MANAGEMENT

(Mechanical Engineering)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Recognize, formulate, and appraise LP models to optimize solutions for industrial scenarios.	4
CO 2	Distinguish and apply the appropriate methodology for addressing real-time problems in the transshipment process	4
CO 3	Appraise and select suitable methodologies for analyzing network problems.	4
CO 4	Utilize and implement suitable techniques for solving production queuing problems.	3
CO 5	Analyze a situation and propose appropriate decisions for replacement.	4

PART- A (5 x 2 = 10 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Define feasible solution and optimal solution in LPP	**1**	**2**
2.	What is an unbalanced transportation problem?	**2**	**2**
3.	Develop a network diagram for the project specified below:	**3**	**2**

ACTIVITY	IMMEDIATE PREDECESSOR ACTIVITY
A	-
B	A
C,D	B
E	C
F	D
G	E,F

4.	What do you mean by the term (i) Jockeying (ii) Reneging	**4**	**2**
5.	Explain saddle point and value of game.	**5**	**2**

PART- B (5 x 15 = 75 Marks)

		Marks	CO	RBT LEVEL

6. (a) A TV company has to decide on the number of 27-inch and 20-inch TV sets to be produced at one of its factories. Market research indicates that almost 40 numbers of 27-inch TV sets and almost 10 numbers of 20-inch TV sets can be sold per month. The maximum no. of work hours available is 500 hours/month. A 27-inch and 20-inch TV requires 20 work hours and 10 work hours respectively. Each 27-inch TV produces a profit of Rs. 120 and each 20-inch TV produces a profit of Rs. 80. A wholesaler agreed to purchase all the TV sets produced if the total numbers of 27-inch and 20-inch TV do not exceed the maximum indicated by market research. Formulate and Optimize the LP model using graphical method. **(15) 1 3**

(b) A company manufactures two types of models M1 and M2. Each M1 model requires 4 hours of grinding and 2 hours of polishing, while each M2 model requires 2 hours of grinding and 5 hours of polishing. The company has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on a M1 model is Rs 30 and on a M2 Model is Rs 40. Formulate the LPP and Justify a suitable method to find the optimal solution. **(15) 1 3**

7. (a) Consider the table shown below and illustrate the Northwest corner method and VAM method for determining the basic feasible solution. Justify the best approach for this problem. **(15) 2 3**

Factories	Retail Agencies					Capacity
	1	2	3	4	5	
A	1	9	13	36	51	**50**
B	24	12	16	20	1	**100**
C	14	33	1	23	26	**150**
Requirement	**100**	**60**	**50**	**50**	**45**	

(OR)

(b) A company wants five jobs to be done. The following matrix shows the return (in ₹) on assigning the i^{th} person to the j^{th} job. **(15) 2 3**

		Jobs				
		J1	**J2**	**J3**	**J4**	**J5**
Persons	**P1**	5	11	10	12	4
	P2	2	4	6	3	5
	P3	3	12	5	14	6
	P4	6	14	4	11	7
	P5	7	9	8	12	5

Use appropriate method to assign the five jobs to the five persons, to maximize the total expected return.

8. (a) Solve the following sequencing problem using Johnson's algorithm to minimize the total elapsed time. **(15) 3 3**

Machines	Job 1	Job 2	Job 3	Job 4	Job 5	Job 6
Milling	5	9	4	7	8	6
Grinding	7	4	8	3	9	5

Also, find the idle time of the machines.

(OR)

(b) A small project is composed of seven activities whose time estimates are listed in the table as follows: **(15) 3 3**

Activity	Preceding activities	Duration
A	---	4
B	---	7
C	---	6
D	A,B	5
E	A,B	7
F	C,D,E	6
G	C,D,E	5

(i) Draw the network and find the project completion time.
(ii) Calculate the three floats for each activity.

9. (a) Vehicle pass through Sriperumbudur Toll gate at a rate of 70 per hour. The average time to pass through the gate is 45 seconds. The arrival rate and service rate follow Poisson distribution. There is a complaint that the vehicles wait for long duration. The authorities are willing to install one more gate to reduce the average time to pass through the toll gate to 35 seconds if the idle time of the toll gate is less than 9% and the average queue length at the gate is more than 8 vehicles. Check whether the installation of the second gate is justified. **(15) 4 3**

(OR)

(b) John's Camera Shop carries a zodiac instant print film. The film normally costs John Rs 3.20 per roll, and he sells it for Rs 5.25. John's average sales are 21 rolls per week. His annual inventory holding cost rate is 25% and it costs John Rs 20 to place an order with Zodiac. If Zodiac offers a 7% discount on orders of 400 rolls or more and a 10% discount for 900 rolls or more, determine John's optimal order quantity. **(15) 4 3**

10. (a) A cricket stadium consists of 10000 electric bulbs. When any bulb fails, it **(15) 5 3**

is replaced immediately and the cost of replacing a bulb individually is ₹ 1/- only. If all the bulbs are replaced at the same time, the cost per bulb will be ₹ 0.35. The percent surviving i.e. S(t) at the end of month 't' and P(t) the probability of failure during the month 't' are as given below. Choose the optimum replacement policy.

t in months:	0	1	2	3	4	5	6
S(t):	100	97	90	70	30	15	0
P(t)	-	0.03	0.07	0.2	0.4	0.15	0.15

(OR)

(b) Two players P and Q play the game. Each of them must choose one of the three colours: White (W), Black (B) and Red (R) independently of the other. Thereafter the colours are compared. If both P and Q has chosen white (W, W), neither wins anything If player P selects white and Player Q black (W, B), player P loses Rs.2/- or player Q wins the same amount and so on. The complete payoff table is shown below. Find the optimum strategies for P and Q and the value of the game. **(15) 5 4**

		Q		
		W	B	R
P	W	0	–2	7
	B	2	5	6
	R	3	–3	8

PART- C (1 x 15 = 15 Marks)

(Q.No.11 is compulsory)

		Marks	CO	RBT LEVEL
11.	Machine A costs ₹ 45,000/- and the operating costs are estimated at ₹ 1000/- for the first year, increasing by ₹ 10,000/- per year in the second and subsequent years. Machine B costs ₹ 50000/- and operating costs are ₹ 2000/- for the first year, increasing by ₹ 4000/- in the second and subsequent years. If we now have a machine of type A, should we replace it by B? If so when? Assume both machines have no resale value and future costs are not discounted.	**(15)**	**5**	**5**

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