CBCS SCHEME

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18MA56

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Operations Research

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. List and explain the phases of Operations Research. **(06 Marks)**

b. The manager of oil refinery has to decide upon the optimal mix of two possible blending processes of which the inputs and outputs per production run are as follows :

Process	Input		Output	
	Crude–A	Crude–B	Gasoline X	Gasoline Y
1	5	3	5	8
2	4	5	4	4

The maximum available of crude A and B are 200 units and 150 units respectively. Market requirements shows that atleast 100 units of gasoline – X and 80 units of gasoline Y must be produced. The profit per production run from process – 1 and 2 are Rs.300/- and Rs.400/- respectively. Formulate as LPP and solve graphically. **(14 Marks)**

OR

2 a. What are the features of operations research? Explain in brief. **(06 Marks)**

b. A company has got 240, 370 and 180kg wood, plastic and steel respectively. The company produces products A and B. Each unit of type A requires 1, 3 and 2kg of wood, plastic and steel respectively corresponding requirement of B are 3, 4 and 1kg. **(14 Marks)**

Module-2

3 a. Solve the following LPP by Simplex method :

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

Subjected to constraints, $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1, x_2, x_3 \geq 0$. **(12 Marks)**

b. Resolve the degeneracy and solve by Simplex.

Max $Z = 3x_1 + 9x_2$

Subjected to, $x_1 + 4x_2 \leq 8$

$x_1 + 2x_2 \leq 4$

$x_1, x_2 \geq 0$. **(08 Marks)**

OR

4 a. Use Big-M method and solve LPP.

Max $Z = 3x_1 - x_2$

Subject to, $2x_1 + x_2 \geq 2$

$x_1 + 3x_2 \leq 3$

$x_2 \leq 4$

$x_1, x_2 \geq 0.$ **(12 Marks)**

b. Use two-phase Simplex method and solve

Minimize $Z = x_1 - 2x_2 - 3x_3$

Subject to, $-2x_1 + x_2 + 3x_3 = 2$

$2x_1 + 3x_2 + 4x_3 = 1$

$x_1, x_2, x_3 \geq 0.$ **(08 Marks)**

Module-3

5 a. Find the initial solution by NWCR and optimum solution by MODI method for the following transportation problem when unit costs are in rupees.

	D_1	D_2	D_3	Supply
O_1	2	2	3	10
O_2	4	1	2	15
O_3	1	3	1	40
Demand	20	15	30	

(12 Marks)

b. A project consists of four jobs for which four contractors have submitted tender. Find the assignment that minimize the total cost in rupees of the project.

		Jobs			
		A	B	C	D
Contractor	1	10	24	30	15
	2	16	22	28	12
	3	12	20	32	10
	4	09	26	34	16

(08 Marks)

OR

6 a. Define :

i) Feasible solution

ii) Balanced TP

iii) Optimal solution. **(06 Marks)**

b. Solve the following TP by VAM and test for optimality when the unit cost are as follows :

	D_1	D_2	D_3	D_4	Supply
O_1	6	1	9	3	70
O_2	11	5	2	8	55
O_3	10	12	4	7	70
Demand	85	35	50	45	

(14 Marks)

Module-4

7 a. Explain briefly, the characteristics of queuing system. **(06 Marks)**

b. A small project is composed of activities whose time estimates are listed below.

Activity	Estimated duration (Weeks)		
	Optimistic	Most likely	Pessimistic
(1 – 2)	1	1	7
(1 – 3)	1	4	7
(1 – 4)	2	2	8
(2 – 5)	1	1	1
(3 – 5)	2	5	14
(4 – 6)	2	5	8
(5 – 6)	3	6	15

Draw the networks :

i) Find the expected duration and variance for each activity.

ii) What is the expected project length

iii) What is the probability that the project will be completed at least 4 weeks earlier and not more than 4 weeks later than expected? **(14 Marks)**

OR

8 a. A Bank has two teller working on saving accounts. The first teller handles withdrawals only. While second teller handles deposits only. It has been found that the service time distribution for deposits and withdrawals follows exponential with mean service time 3 minutes per customer. Deposits are found to arrive in a Poisson fashion throughout the day with mean arrival rate of 16/hour. Withdrawals also arrive a Poisson's fashion with mean arrival of 14/hour.

i) What would be the effect on the average waiting time for depositors and withdrawers? If each teller would handle both withdrawal and deposits.

ii) What would be the effect, if this could only be accomplished by increasing time to 3.5 minutes? **(12 Marks)**

b. Draw the network and find the critical path :

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	–	–	A	A	B, C	B, C	E	E	D, G	F, H, I
Duration	15	15	3	5	8	12	1	14	3	14

(08 Marks)

Module-5

9 a. Brief explain :
i) Saddle point
ii) Pure and mixed strategy
iii) Dominance rule
iv) Two person zero sum game. **(08 Marks)**

b. Solve the following game graphically :

	I	II	III
I	1	3	11
II	8	5	2

(12 Marks)

OR

10 a. What are the assumptions made while dealing with sequencing problems? **(06 Marks)**

b. Two jobs are to be processed on 5 machines A, B, C, D and E. The technological order for these jobs on the machine and processing time of each job on each machine are as follows :

Job 1	A – 2	B – 3	C – 4	D – 6	E – 2	= 17 hours
Job 2	C – 4	A – 5	D – 3	E – 2	B – 6	= 20 hours

Determine the minimum elapsed time to complete all jobs and also determine optimal sequence of each job. **(14 Marks)**

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