VPM's
DR VN BRIMS, Thane
Programme: MMS (2015-17) (Operations)
Third Semester Examination October 2016

Subject	**Quantitative Methods in Operations**		
Roll No.		**Marks**	**60 Marks**
Total No. of Questions	**7**	**Duration**	**3 Hours**
Total No. of printed pages	**2**	**Date**	**24.10.2016**

Note: Q1 is compulsory and solve any FOUR from the remaining SIX questions.

Q1) 20 Marks (Compulsory)

Answer the following questions. Sub-question a carries 12 marks and sub-question b carries 8 marks.

a) A project consists of the following activities. Draw the network diagram and find the critical path. Also find all the floats for all the activities.

Activity	A	B	C	D	E	F	G	H
Predecessor Activity	-	-	A	A	B, C	B, C	D, E	F
Duration (Weeks)	5	6	7	8	2	9	3	10

b) Write a short note on queuing theory.

Attempt Any FOUR from the Remaining SIX Questions

Q2) *Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks*

a) What are the various costs associated with inventory?

b) Assembly line for product A requires wire meshes as a component. This component is produced in a job shop at the rate of 180 units per day. The setup cost for the same is Rs. 2,500 per order. The annual demand of the meshes is 40,000 units. The assembly line uses the meshes at the rate of 80 units per day. What is the economic order quantity (EOQ) for the production of the meshes? The other details are as follows.

- Annual Holding Cost (H) = Rs. 45 per unit
- Cost of component = Rs. 250 per unit
- Lead Time = 7 days
- Number of working days in a year = 250

c) For the above question what is the reorder point? What is the total cost at the EOQ?

Q3) *Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks*

a) The following table represents the supply available at three plants A, B and C and demand at three warehouses A, B, and C along with the corresponding costs of transportation. Find the optimal allocation that minimizes the total cost of transportation. Use any method to solve.

	Warehouse P	Warehouse Q	Warehouse R	Supply
Plant A	1	9	3	70
Plant B	5	2	8	55
Plant C	12	4	7	90
Demand	65	80	70	

b) In continuation to the above problem, the next two tables give the costs of transportation from plants to plants and warehouses to warehouses respectively. Perform the first iteration on the transshipment problem.

	Plant A	Plant B	Plant C
Plant A	-	2	6
Plant B	4	-	2
Plant C	2	6	-

	Warehouse P	Warehouse Q	Warehouse R
Warehouse P	-	8	2
Warehouse Q	5	-	9
Warehouse R	2	1	-

c) Perform the second iteration on the transshipment problem. Find the cost of the transshipment after the second iteration. Is it the optimal solution?

Q4) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) Write a short note on dynamic programming.

b) A transport company delivers four types of containers between New Delhi and Mumbai. The company wishes to load a minimum of 15 tons on each truck. The weight and handling cost paid to porters for each type of container is given below. Find out how many containers should be loaded on each truck so that the total handling cost is minimized. Solve by using dynamic programming. Perform calculations of two stages in this question.

Container	Weight (tons)	Handling Cost (Rs.)
A	5	780
B	3	600
C	4	720
D	6	840

c) In continuation to the above question perform the calculations for the next two stages in this question.

Q5) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) Write a short note on goal programming.

b) A company produces three items A, B and C. All these are processed in a central plant. Production of one unit of A, B, and C needs 2 hours, 3 hours and 1 hour, respectively. The regular plant capacity is 40 hours per week. The marketing department has informed the maximum sales per week of A, B and C is 10, 10 and 12 units, respectively. The chief executive of the company has established the following goals according to their Importance. Formulate the constraints of the problem.

i. Avoid any underutilisation of production capacity.
ii. Meet the order for 7 units of B and 5 units of C per week.
iii. Avoid the overtime operation of the plant beyond 10 hours.
iv. Achieve the sales goal of 10 units of A, 10 units of B and 12 units of C.
v. Minimise the overtime operation as much as possible.

c) Formulate the objective function of the problem. Write the first simplex table for the problem.

Q6) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) Write a short note on cutting plane algorithm used to solve integer programming problems.

b) A company manufactures two types of cricket balls. A white ball named ‘White Fire’ is used for ODI matches. The second variety of ball is used for Test Matches and is named ‘Red Fury’. Each unit of White Fire takes 2.5 hours and one unit of Red Fury takes 1 hour to produce. The company has only 2000 hours of production time every day. The availability of raw material which is the red core is 1500 units per day. Each of White Fire and Red Fury require one unit of raw material per unit. White Fire fetches a profit of Rs 4 per unit while Red Fury gets a profit of Rs 3 per unit. Formulate this as an integer programming problem to find the optimal production mix to maximize profit.

c) Solve this integer programming problem using simplex method. Perform only the first two iterations.

Q7) ***Any two from (a) or (b) or (c) ———— (5x2) = 10 Marks***

a) A farmer grows radish and potato. The revenue per dozen of radish and potato is Rs. 10 and Rs.15 respectively. Both these outputs require labor hours and fertilizers. The labor hours required per dozen of radish and potato is 2 hr and 1 hr respectively. The fertilizer required per dozen of radish and potato are 2 kg and 4 kg respectively. The total labor hours available are 26. And the total fertilizer available is 56 kg. Formulate this as a linear programming problem.

b) Using simplex method perform the first iteration.

c) Using simplex method find the optimal solution.