Paper : M.C. 205 : OPERATIONS RESEARCH

(Same for USOL Candidates)

Time Allowed : Three Hours **Maximum Marks : 80**

Note : Attempt **five** questions, at least **one** question from each unit. Each question carries 16 marks.

UNIT—I

1. (a) A transistor radio company manufactures models A, B and C which have profit contributions of 8,15 and 25 respectively. The weekly minimum production requirements are 100 for model A, 150 for model B and 75 for model C. Each type of ratio requires a certain amount of time for the manufacturing of component parts, for assembling and packing. Especially a dozen units of model A require three hours of manufacturing, four hours of assembling and one hour of packing. The corresponding figures for a dozen units of model B are 3.5, 5 and 1.5 and for a dozen units of model C are 5, 8 and 3. During the forthcoming week the company has available 150 hours of manufacturing, 200 hours of assembling and 60 hours of packing time. Formulate the production scheduling problem as a linear programming model.

   (b) Write down the steps of the graphical method to obtain an optimal solution to a linear programming problem.

2. Use duality to solve the L.P.P.

   Minimize $Z=2\chi_1 + 1\chi_2$ subject to :

   $2\chi_1 + 4\chi_2 \geq 1, -\chi_1 - 2\chi_2 \leq -1, 2\chi_1 + \chi_2 \geq 1$ and $\chi_1, \chi_2 \geq 0$.

3. What are the various phases of O.R. problem ? Explain them briefly. Also explain the steps involved in the solution of O.R. problem.

UNIT-II

4. (a) Briefly describe the steps for solving a transportation problem.

   (b) Solve the following assignment problem :

	I	II	III	IV	V	
A	1	3	2	3	6	
B	2	4	3	1	5	
C	5	6	3	4	6	
D	3	1	4	2	2	
E	1	5	6	5	4	

5. (a) What are the rules to determine degeneracy ?

(b) Freshwater is supplied through 3 reservoirs with daily supply capacities of 15, 20 and 25 million litres of water respectively. On each day supply must be provided for 4 cities A, B, C and D whose demands are 8, 10, 12 and 15 million litres respectively, whose costs are given below :

		Cities			
		A	B	C	D
Reservoirs	1	2	3	4	5
	2	3	2	5	2
	3	4	1	5	2

Use the transportation algorithm to determine the cheapest pumping schedule, if excess water can be disposed off at no cost.

UNIT-III

6. (a) Explain the steps involved in critical path method.

(b) Assuming that the expected times are normally distributed, find the critical path and project duration of :

Activity	Days		
	Optimistic	Most likely	Pessimistic
	Time	Time	Time
1-2	2	5	14
1-3	9	12	15
2-4	5	14	17
3-4	2	5	8
3-5	8	17	20
4-5	9	9	12

7. The following table gives the activities in a construction project and other relevant information :

Activity	Preceding activity	Normal time (days)	Crash time(days)	Normal cost (Rs.)	Crash cost (Rs.)
(1-2)	-------	20	17	600	720
(1-3)	-------	25	25	200	200
(2-3)	(1-2)	10	8	300	440
(2-4)	(1-2)	12	6	400	700
(3-4)	(1-3), (2-3)	5	2	300	420
(4-5)	(2-4), (3-4)	10	5	300	600

(a) Draw activity network of the project.

(b) Find total float and free float of each activity.

(c) Using the above information "crash" or shorten the activity step by step until the shortest duration is reached.

8. Write a note on the following :

(a) Explain the role of L.P.P. as a decision making tool.

(b) Unbalanced transportation issue.

(c) Multiple optimal solution and infeasibility.

(d) Explain a few important replacement situations and placement policies.

UNIT–IV

9. (a) Give essential characteristics of queuing procedure.

(b) On an average 96 patients per 24 hours day require the service of an emergency clinic. Also on an average, a patient requires 10 minutes of active attention. Assume that the facility can handle only one emergency at a time. Suppose that it costs the clinic Rs. 100 per patient treated to obtain an average servicing time of 10 minutes and that each minute of decrease in this average time would cost Rs. 10 per patient treated. How much would have to be budgeted by the clinic to decrease the average sizes of the queue from 1 1/3 patients to ½ patient ?

10. Arrival of machinists at a tool crib is considered to be Poisson distribution at an average rate of 6 per hour. The length of time the machinists must remain at the tool crib is exponentially distributed with an average time being 0.05 per hour.

(a) What is the probability that the machinists arriving at tool crib will have to wait ?

(b) What is the average number of machinists at the tool crib ?

The company will install a second tool crib when convinced that a machinist would expect to have spent at least 6 minutes waiting and being serviced at the tool crib. By how much must the flow of machinists to tool crib increase to justify the addition of a second tool crib ?