2010

M. Com.

1st Semester Examination

OPERATIONS RESEARCH

PAPER — COM-103

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Unit—I

[Marks : 20]

1. Answer any *two* of the following : 2×5

(a) Why in the simplex formulation of a linear programming problem is it necessary to add

(i) an artificial variable for an *equality* constraint,

(ii) both an artificial variable and a surplus variable for a *greater than equality* constraint ?

(b) How does the problem of degeneracy arise in a transportation problem ? Explain how you can resolve such degeneracy.

(c) Explain the term 'shadow price' in the context of linear programming. Where is it found in a simplex table ?

(d) Give an algorithm to solve an assignment problem.

2. Answer any *one* of the following : 1×10

(a) A salesman has to visit five cities. The costs involved in visiting different cities from other cities are represented in the following matrix.

		To City (Cost in Rs.)				
		P	Q	R	S	T
From City	A	—	25	32	34	39
	B	26	—	31	36	29
	C	32	33	—	41	31
	D	30	21	30	—	25
	E	28	45	28	36	—

Determine the optimum sequence the salesman should follow to minimise the total costs for visiting all the cities in a single trip, Find out the total costs involved.

(b) Three products are produced using three resources. The quantity of resources available, the unit consumption of these resources for production of different products, and the profit per unit sale of the products are indicated by the table below.

		Products			
		X	Y	Z	
Resources	A	1	2	1	≤ 11
	B	1	1	1	≤ 9
	C	2	1	1	≤ 12
Profit		3	2	4	

Find an optimum production programme using simplex method.

Unit—II

[Marks : 20]

3. Answer any *two* of the following questions : 2×5

(a) Distinguish between event and activity. What do you mean by dummy activity ? Explain its role in network analysis.

(b) Explain inventory model with a finite rate of replenishment. How can you determine the EOQ and the total inventory cost using this model ?

(c) What do you mean by an empty queue and a non-empty queue ? Explain average queue length in the context of both the types of queues.

(d) What is slope in network analysis ? Explain its significance in crashing the duration of a project.

4. Answer any *one* of the following : 1×10

(a) The following table gives data on normal time and cost and crash time and cost for a project :

Activity	*Normal Time (days)*	*Normal Cost (Rs.)*	*Crash Time (days)*	*Crash Cost (Rs.)*
1–2	8	100	6	210
1–3	4	150	2	350
2–4	2	50	1	90
2–5	10	100	5	400
3–4	5	100	1	200
4–5	3	80	1	100

Indirect cost is Rs. 70 per day.

You are required to :

(i) draw the network, identify the critical path, and determine the normal project completion time and cost;

(ii) crash the activities systematically and determine the optimum project completion time and cost; and

(iii) also determine the minimum possible project completion time ignoring cost increase.

2+7+1

(b) (i) Find the optimal order quantity for the price-break inventory problem, which is given as follows :

Annual demand : 200 units, Carrying charges : 25%, Ordering cost : Rs. 20 per order.

Quantity (Q)	*Price (Rs. per unit)*
$Q \leq 50$	10.00
$50 < Q \leq 100$	9.00
$100 < Q$	8.00

(ii) At a certain Petrol Pump, customers arrive in a Poisson process with an average time of 5 minutes between intervals. The time intervals between services at the Petrol Pump follow exponential distribution and as such the mean time taken to service a unit is 2 minutes. On the basis of the information you are to answer the following :

(x) What would be the expected average queue length ?

(y) How long on an average a customer does wait in the queue ?

(z) By how much should the flow of customers be increased to justify the opening of a second service point if the management is willing to open the same provided the customer has to wait for 5 minutes for the service ? 6+4

[Internal Assessment : 10 Marks]