

Roll No:
 Total No. of Questions: 8
 Duration (hrs): 3 hrs.

Total No. of Printed Pages: 3
 Maximum Marks: 60

Note:

- (i) Solve any **Two** questions out of given (Q-1, Q-2, Q-3) **Three** questions.
- (ii) Solve any **Three** questions out of given (Q-4, Q-5, Q-6, Q-7, Q-8) **Five** questions
- (iii) Sub-questions of each question should be solved at one place strictly
- (iv) Rough work should be done on extra supplementary and attach it at the end.
- (v) Draw neat and clean diagram wherever required

(15 Marks)

- Q) 1) (a) Write the important components in linear programming problem structure with suitable examples. (02)

A company manufactures two types of gadgets A and B which are first processed in the foundry and then sent to machine shop for finishing. The number of man-hours required in each shop for the production of each unit of A and B and the number of man-hours the firm has available per week are as follows:

Gadget	Foundry	Machine Shop	Profit on the sale per unit
	Man-hours per piece		
A	10	4	Rs 30
B	5	8	Rs 20
Capacity per week	3,000	2,400	

- (a) Formulate the linear programming problem and solve it. (04 + 06)
- (b) Write the dual of the given problem. (03)

- Q) 2) (a) Feasible solutions are given in following two cases where given matrix are transportation cost matrix. Test

- (i) The non-degeneracy of the feasible solutions. (01 + 01)

Origins / Destinations	D1	D2	D3	D4	Supply
S1	19 5	30	50	10 2	7
S2	70	30 2	40 7	60	9
S3	40	8 6	70	20 12	18
Demand	5	8	7	14	34

ii) Optimality of the obtained feasible solutions. (03 + 03)

Origins / Destinations	W 1	W 2	W 3	Supply
F 1	16 180	20 20	12	200
F 2	14	08 100	18 60	160
F 3	26	24	16 90	90
Demand	180	120	150	450

(07 Marks)

- Q) 2) (b) The owner of a machine shop has four operators available to assign four different machines. The assignment costs are given below. A dash in the cost matrix indicates that the operator cannot be assigned to the machine. Find the optimal assignment schedule.

MACHINES				
Operators	I	II	III	IV
A	22	24	—	10
B	32	18	10	14
C	38	16	22	—
D	30	10	26	30

- Q) 3) (a) Define critical path in network diagram. What special feature does a critical path possess in terms of activities involved in it? (03)
 A project involving development of an item with a supplier consists of eleven activities. The technological relationships between the activities and activity durations are given in the table below:

Activity	Preceding Activity	Duration
A	—	2
B	A	4
C	A	1
D	A	4
E	D	5
F	C	2
G	C	2
H	B	5
I	F	1
J	E, G	5
K	H, I, J	4

- i) Construct arrow diagram of the project. (04)
 ii) How many weeks are required to develop the supplier for regular supply of this item? (03)
 iii) Mention name of three –time estimates required in PERT model. Also explain them. (03)
 iv) Write mathematical formula for expected activity time and variance calculated with the help of three time – estimates in PERT model. (02)

- Q-4 Find the optimal order quantity for a product when the annual demand for it is 500 units, the cost of storage per unit per year is 10 % of the unit cost and ordering cost per order is Rs. 180. The unit costs are given below: (7)

Quantity	Unit Cost
0 $\leq q_1 < 500$	Rs. 25.00
500 $\leq q_2 < 1,500$	Rs. 24.80
1500 $\leq q_3 < 3000$	Rs. 24.60
3000 $\leq q_4$	Rs.24.40

- b) What is inventory? And what are the different costs towards maintaining inventory? (3)

- Q-5 a) Why Simulation is today's necessity in the businesses? (2)

- b) A co. manufactures around 200 bikes. Depending upon the raw material availability & other conditions, the daily production has been varying from 197 bikes to 203 bikes, whose probability distribution is as: (8)

Daily Production	197	198	199	200	201	202	203
Probability	0.12	0.18	0.16	0.22	0.08	0.10	0.14

These bikes are transported in lorry having capacity of 200 bikes only. Using given random numbers simulate the process to find out average number of bikes waiting in the factory & average numbers of empty spaces in the lorry for given 10 days.

21, 86, 68, 45, 19, 73, 71, 23, 70, 90.

- Q-6 a) State the importance of Replacement and Maintenance Models in manufacturing industries? (2)
 b) Purchase price of a machine is Rs.3000, and its running cost is as given below, if the discount rate is 10%, find at what age the machine should be replaced. (8)

Year	1	2	3	4	5	6	7
Running cost (Rs.)	500	600	800	1,000	1,300	1,600	2,000

- Q-7 a) How queuing theory (waiting line) is applicable in Service industry? And write about Kendall's notation. (4)
 b) In a bank, cheques are cashed at a single "teller" counter. Customers arrive at the counter in a Poisson manner at an average rate of 30 customers per hour. The teller takes on an average, a minute and a half to cash a cheque. The service time has been shown to be exponentially distributed
 i) Calculate the percentage of time the teller is busy.
 ii) Calculate the average time a customer is expected to wait. (6)
- Q-8 a) What is Game theory? Explain Payoff matrix. (3)
 b) A and B play a game in which each has three coins a 5p, a 10p and a 20p. Each player selects a coin without the knowledge of the other's choice. If the sum of the coins is an odd amount, A wins B's coin; if the sum is even, B wins A's coin. Find the best strategy for each player and the value of the game. (7)