Reg. No. : | | | | | | | | | | | | |

Question Paper Code : Q 2307

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Eighth Semester

Mechanical Engineering

ME 1018 — OPERATIONS RESEARCH

(Common to Eighth Semester — Automobile Engineering and Sixth Semester — Mechatronics Engineering)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a linear model?

2. What is a constraint?

3. What is an unbalanced transportation problem?

4. What is the rule of deciding optimality in an assignment problem?

5. Distinguish between PERT and CPM.

6. What is float?

7. Why should assets be replaced?

8. What is time value of money?

9. Give two assumptions of queuing theory.

10. Give two uses for queuing theory.

PART B — (5 × 16 = 80 marks)

11. (a) A company has two grades of inspectors 1 and 2, who are to be assigned for a quality control inspection. It is required that at least 2000 pieces be inspected per 8 hour day. Grade 1 inspector can check prices at the rate of 40 per hour, with an accuracy of 97%. Grade 2 inspector checks at the rate of 30 pieces per hour with an accuracy of 95%. The wage rate of grade 1 inspector is Rs. 5/hour, and that of grade 2 inspector is Rs. 4/hour. An error costs Rs. 3 to the company. There are only nine grade 1 inspectors and eleven grade 2 inspectors available in the company. The company wishes to assign work to the available inspectors so as to minimize the total cost of inspection. Formulate the LPP to minimize daily inspection costs. (16)

Or

(b) Use graphical method to solve the following L.P.P. : (16)

Minimize $Z = -x_1 + 2x_2$

subject to constraints

$-x_1 + 3x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1, x_2 \geq 0.$

12. (a) A company has factories at f_1, f_2 and f_3, which supply to warehouses W_1, W_2 and W_3. Weekly factory capacities are 200, 160 and 90 units respectively. Weekly warehouse requirement are 180, 120 and 150 units respectively. Unit shipping costs (in rupees) are as follows :

	W_1	W_2	W_3
f_1	16	20	12
f_2	14	8	18
f_3	26	24	16

Find the initial feasible solution using N.W. Corner rule and optimise the solution using MODI method. (16)

Or

(b) A City Corporation has decided to carry out repairs on four major dispensaries of the city. The government has agreed to make a special grant of Rs. 50 lakh towards the costs with a condition that the repairs must be done at the lowest cost and quickest time. If conditions warrent, then a supplementary taken grant will also be considered favourably. The Corporation has floated tenders and five contractors have sent in their bids. In order to expedite work, on dispensary will be awarded to only on contractor. (16)

Cost of Repairs (Rs. lakhs)

	Dispensary			
Contractor	D_1	D_2	D_3	D_4
C_1	9	14	19	15
C_2	7	17	20	19
C_3	9	18	21	18
C_4	10	12	18	19
C_5	10	15	21	16

Assign the dispensary repair work to the best contractors. Find the total minimum cost of allocation and identify which contractor is left out of the repair work.

13. (a) A small project consists of seven activities, the details of which are given below :

	Duration (Days)			
Activity	Most likely	Optimistic	Pessimistic	Preceding Activity
A	3	1	7	—
B	6	2	14	A
C	3	3	3	A
D	10	4	22	B, C
E	7	3	15	B
F	5	2	14	D, E
G	4	4	4	D

Draw the network, find the critical path and the expected project completion time. (16)

Or

(b) The following table gives the activities in a construction project :

Activity	Preceding activity	Time (Months)		Cost (Rs. '000)	
		Normal	Crash	Normal	Crash
A	—	4	3	60	90
B	—	6	4	150	250
C	—	2	1	38	60
D	A	5	3	150	250
E	C	2	2	100	100
F	A	7	5	115	175
G	D, B, E	4	2	100	240

The indirect costs vary as follows :

Months :	15	14	13	12	11	10	9	8	7	6
Cost (Rs.) :	600	500	400	250	175	100	75	50	35	25

Draw the network diagram, find the critical path. Find the net savings if the project is crashed by two months. (16)

14. (a) A firm is considering replacing a machine whose cost is Rs. 12,200, and the scrap value is Rs. 200. The running costs are as follows :

Year :	1	2	3	4	5	6	7	8
Running cost (Rs.) :	200	500	800	1,200	1,800	2,500	3,200	4,000

When should the machine be replaced? (16)

Or

(b) There are six jobs, each of which must go through machines A, B and C in the order A, B, C. Processing time in hours are given below :

Job :	1	2	3	4	5	6
Machine A :	8	3	7	2	5	1
Machine B :	3	4	5	2	1	6
Machine C :	8	7	6	9	10	9

Determine the best sequence for the jobs so as to minimise the total processing time. Also find the idle time on each of the machines. (16)

15. (a) A super market has two sales girls at the sales counters. If the service time for each customer is exponential with a mean of 4 minutes, and if people arrive in a Poisson distribution at the rate of 10 an hour, then calculate :

(i) The average waiting time of a customer in the system.

(ii) The average waiting time of a customer in the queue.

(iii) The average number of people in the system.

(iv) The average number of people in the queue. (16)

Or

(b) A bank has two tellers working on savings accounts. The first teller handles withdrawals only. The second teller handles deposits only. It has been found that the service time distribution for the deposits and withdrawal are exponential with a mean time of three minutes per customer. Depositors are found to arrive in a Poisson fashion at an average arrival rate of 16 per hour. Withdrawers also arrive in a Poisson way with a mean of 14 per hour. Find the average waiting for depositors and withdrawers in the system. If each teller handles both deposits and withdrawals, what would be the waiting time of withdrawers and depositors in the system? (16)
