C 3293

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

Sixth Semester

Mechatronics Engineering

ME 1018 — OPERATIONS RESEARCH

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. While using two phase method the artificial objective function is to be always minimized. True or false? Justify' your answer.

2. Explain degeneracy in transportation problem.

3. What is balanced type transportation problem?

4. What is the need for using dummy activities in a net work?

5. Define critical path.

6. Explain slack time.

7. How group replacement is different from individual replacement in case of items that fail completely?

8. What is the role of rate of return in a replacement model?

9. What is meant by queue discipline?

10. Give any three industrial applications of queuing theory.

PART B — (5 × 16 = 80 marks)

11. (a) Solve the given LPP using simplex method.

Max : $Z = 2x_1 + x_2 + x_3$

Subject to $x_1 \leq 12$

$x_2 \leq 5$

$x_1 + 2x_2 + 3x_3 \leq 24$

$x_1, x_2, x_3 \geq 0$

Or

(b) Use two phase simplex method to

maximize $Z = 5x_1 + 3x_2$,

Subject to the constraints $2x_1 + x_2 \leq 1$,

$x_1 + 4x_2 \geq 6$,

$x_1, x_2 \geq 0$.

12. (a) (i) Solve the following transportation problem. (8)

	Warehouse					
	W1	W2	W3	W4	W5	Capacity
F1	4	2	3	2	6	8
F2	5	4	5	2	1	12
F3	6	5	4	7	3	14
Requirement	4	4	6	8	8	

(ii) Solve the assignment problem represented by the matrix : (8)

	a	b	c	d	e	f
A	9	22	58	11	19	27
B	43	78	72	50	63	48
C	41	28	91	37	45	33
D	74	42	27	49	39	32
E	36	11	57	22	25	18
F	3	56	53	31	17	28

Or

(b) (i) A company has one surplus truck in each of the cities A,B,C,D and E and one deficit truck in each of the cities 1,2,3,4,5 and 6. The distance between the cities in kilometers is shown in the matrix. Find the assignment of the trucks from cities in surplus to cities in deficit so that the total distance covered by vehicles is minimum. (8)

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

(ii) Determine the optimum basic feasible solution to the following transportation problem. (8)

		To			Available
	I	50	30	220	1
From	II	90	45	170	3
	III	250	200	50	4
Required		4	2	2	

13. (a) A project schedule has the following characteristics : (3 + 3 + 3 + 3 + 4)

Jobs :	1–2	1–3	2–4	3–4	3–5	4–5	4–6	5–6
Duration :	6	5	10	3	4	6	2	9

Draw the net work. Find the critical path and its duration. Also calculate the total float and free float for each job.

Or

(b) A project has the following activities and time estimates :

Activity :	A	B	C	D	E	F	G	H	I
Dependence :	–	–	A	A	C	D	B	E, F	G
Optimistic time :	4	1	6	2	5	3	3	1	4
Most likely time :	7	5	12	5	11	6	9	4	19
Pessimistic time :	16	15	30	8	17	15	27	7	28

Draw the PERT diagram and find the critical path. What is the expected length of the critical path and what is its variance? Also find the probability that the project is completed in 36 weeks.

14. (a) A stamping machine currently valued at Rs. 19,000 is expected to last 2 years and costs Rs. 4000 per year to operate. Another machine which can be purchased for 30,000 will last for 4 years and be operated at an annual cost of Rs.3,000. If money carries the rate of interest at 10% per annum, determine which stamping machine should be purchased?

Or

(b) Five jobs must go through 3 machines in the order of ABC. Determine the sequence that will minimize the total lapsed time.

Job Number	1	2	3	4	5
Machine A	5	7	6	9	5
Machine B	2	1	4	5	3
Machine C	3	7	5	6	7

15. (a) Assume that patients come to a hospital clinic at the rate of 4 patients per hour. The arrivals are Poisson distributed and the clinic treats patients at an avenge rate of 6 patients an hour. Treatment time is exponentially distributed and a first come, first served queue discipline is used.

(i) Calculate the Clinic's idle time

(ii) Calculate the probability that there are at least two patients in the clinic.

(iii) What is the average number of patients waiting to be treated?

(iv) What is the average number of patients in the clinic?

Or

(b) Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially, with mean 3 minutes.

(i) What is the probability that a person arriving at the booth will have to wait?

(ii) What is average length of the queues that form from time to time?

(iii) The telephone company will install a second booth when convinced that an arrival would expect to have to wait at least three minutes for the phone. By how much must the flow of arrivals be increased in order to justify a second booth?