2090
B.E. (Mechanical Engineering)
Eighth Semester
MEC-802: Operation Research

Time allowed: 3 Hours

Max. Marks: 50

Note: Attempt 50% of Total Questions of Question Paper. Time: 2 Hours   *compulsory*
All will carry equal marks. Fraction will be lower digit.

x-x-x

Q1. (a) What is degeneracy in transportation problem?   2*5=10

(b) What conditions must exist in a simplex table to establish the existence of unbounded solution?

(c) How do you detect an unbounded solution in the simplex procedure?

(d) Differentiate between CPM and PERT.

(e) What is duality? What is the significance of dual variable in an LP model?

Section A

Q2. (a) Write down the limitations of OR and explain various assumptions to be made in Linear   5

Programming problems?

(b) What is meant by a mathematical model of a real situation? Discuss the importance of   5

models in the solution of OR problems.

Q3. Solve the following LPP by using Big-M method: 10

$$\text{Maximize} \quad Z = 3x_1 - x_2$$
$$\text{subject to} \quad 2x_1 + x_2 \geq 2,$$
$$x_1 + 3x_2 \leq 3,$$
$$x_2 \leq 4,$$
$$\text{and} \quad x_1, x_2 \geq 0$$

Q4. Solve the following LP problem by dual simplex method :   10

$$\text{Minimize} \ Z = 2x_1 + 2x_2 + 4x_3$$
$$\text{subject to} \quad 2x_1 + 3x_2 + 5x_3 \geq 2,$$
$$3x_1 + x_2 + 7x_3 \leq 3,$$
$$x_1 + 4x_2 + 6x_3 \leq 5,$$
$$\text{and} \ x_1, x_2, x_3 \geq 0$$

Section B

Q5. There are 4 jobs A, B, C and D and these are to be performed on four machine centres I,   10
II, III and IV. One job is to be allocated to a machine centre. Each machine is capable of
doing any job, at different costs (in suitable units) given by the matrix below. Find the
optimal assignment.

		Machine Centres			
		I	II	III	IV
	A	1	2	3	4
Jobs	B	3	5	9	13
	C	17	25	33	43
	D	51	61	72	87

P.T.O.

Q6. (a) Explain the basic elements of a queuing system.   4

(b) There is a toll arrangement in a newly opened bridge on a highway system. The company   6 has appointed only one attendant at the toll gate. Vehicles arrive at the toll gate at the rate of 120 vehicles per hour and it takes the attendant on an average 15 seconds to attend to a vehicle. Arrivals are Poisson whereas service times are exponentially distributed. Determine the following:

(i) Proportion of time the server is busy.

(ii) Probability that the system will have no vehicles.

(iii) Expected number of vehicles in the system.

Q7. Following is the list of activities and their predecessor along with their activity times: 10

Activity	A	B	C	D	E	F	G
Immediate Predecessor	-	A	A	B	B	C,D	E,F
Activity Time(weeks)	4	3	2	5	3	4	3

Construct the network diagram, find the critical path and compute total float for each activity.

x-x-x