

(2 ½ Hours)

[Total Marks: 75]

- N.B. 1) All questions are compulsory.
 2) Figures to the right indicate marks.
 3) Illustrations, in-depth answers and diagrams will be appreciated.
 4) Mixing of sub-questions is not allowed.

Q. 1 Attempt ANY FOUR from the following:

(20M)

- (a) Discuss the application areas of LPP.
 (b) What is the standard form of an LP problem?
 (c) Use the graphical method to solve the following LP problem.
 Maximize $Z = 2x_1 + x_2$
 subject to the constraints
 (i) $x_1 + 2x_2 \leq 10$,
 (ii) $x_1 + x_2 \leq 6$,
 (iii) $x_1 - x_2 \leq 2$,
 (iv) $x_1 - 2x_2 \leq 1$
 and $x_1, x_2 \geq 0$.
- (d) How is classification done in operation research? Explain predictive & physical model.
 (e) Evening shift resident doctors in a government hospital work five consecutive days and have two consecutive days off. Their five days of work can start on any day of the week and their schedule rotates indefinitely. The hospital requires the following minimum number of doctors to work on the given days:

Sun	Mon	Tue	Wed	Thu	Fri	Sat
35	55	60	50	60	50	45

- No more than 40 doctors can start their five working days on the same day. Formulate this problem as an LP model to minimize the number of doctors employed by the hospital.
 (f) What is linear programming? What are its major assumptions and limitations?

Q. 2 Attempt ANY FOUR from the following:

(20M)

- (a) Explain the steps of Branch and Bound method.
 (b) Write the dual to the following LP problem.
 Maximize $Z = x_1 - x_2 + 3x_3$
 subject to the constraints
 (i) $x_1 + x_2 + x_3 \leq 10$,
 (ii) $2x_1 - x_2 - x_3 \leq 2$,

(iii) $2x_1 - 2x_2 - 3x_3 \leq 6$
and $x_1, x_2, x_3 \geq 0$

(c) Write note on the principle of complementary slackness

(d) State the rules for constructing the Dual from Primal.

(e) Write the dual of the following primal LP problems:

Max $Zx = 2x_1 + 5x_2 + 6x_3$

subject to (i) $5x_1 + 6x_2 - x_3 \leq 3$

(ii) $-2x_1 + x_2 + 4x_3 \leq 4$

(iii) $x_1 - 5x_2 + 3x_3 \leq 1$

(iv) $-3x_1 - 3x_2 + 7x_3 \leq 6$

and $x_1, x_2, x_3 \geq 0$.

(f) Draw tree diagram of Integer Linear Programming and explain cutting plane method.

Q. 3 Attempt ANY FOUR from the following:

(20M)

(a) Explain the difference between LP and GP approach

(b) Write note on 1. Enumeration method 2. Simplex method

(c) Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do each job is known and is given in the following table:

	JOBS					
	I	II	III	IV	V	
MEN	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

Find out how men should be assigned the jobs in way that will minimize the total time taken.

(d) Write a note on transportation problem.

(e) A marketing manager has five salesmen and five sales districts. Considering the capabilities of the salesmen and the nature of districts, the marketing manager estimates that the sales per month (in hundred rupees) for each salesman in each district would be as follows:

	Districts					
	A	B	C	D	E	
Salesmen	1	32	38	40	28	40
	2	40	24	28	21	36
	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39

Find the assignment of salesmen to districts that will result in maximum sales.

- (f) What is duality? What is the significance of dual variables in an LP model?

Q. 4 Attempt ANY FIVE from the following:

(15M)

- (a) Write note on 1. Probabilistic model 2. Deterministic model.
- (b) How economic Interpretation of Dual Variables does is done?
- (c) What is the method of finding an initial solution?
- (d) Explain the role of model and modelling in operation research.
- (e) Explain sensitivity analysis in Linear Programming
- (f) Explain the mathematical model of assignment problem.
