Note : Answer all questions.

PART – A   (10×2=20 Marks)

1. Explain the following briefly :

   a) Define operation Research.

   b) What is Non-Linear Programming ?

   c) What is degeneracy in TP ?

   d) Sensitivity analysis in LPP.

   e) What is balanced transportation problem ?

   f) What is assignment problem ?

   g) What is PERT ?

   h) Earliest start time, latest finish time and total activity slack.

   i) What is cost of facility provision ?

   j) What are pure strategy, mixed strategy and saddle point ?

PART – B   (5×12=60 Marks)

2. a) Discuss the significance and scope of operation research in modern management.

                    OR

   b) Use the graphical method to solve the following L.P. problem

   Maximise $Z = 5X_1 + 2X_2$

   Subjected to constraints

   $2X_1 + 3X_2 \leq 150$

   $\quad 3X_1 \leq 150$

   $\quad 5X_2 \leq 200$

   And $X_1, X_2 \geq 0$

3. a) A company makes three products X, Y and Z, which flow through three departments Drill, Lathe and Assembly. The hours of department time required by each of the product, the hours available in each of the department and profit contribution of each of the product are given in the following table :

Product	Time requirement			Contribution Per Unit (Rs.)
	Drill	Lathe	Assembly	
X	3	3	8	9
Y	6	5	10	15
Z	7	4	12	20
Hours available	210	240	260	

   The marketing department of the company indicates that the sale potential for product X and Y is unlimited but for product Z, It is only 30 units. Determine the optimum production schedule.

OR

$X_1 + X_2 \leq 2$

$2X_1 + X_2 \leq 4$

$3X_1 + 8X_2 \leq 12$

And $X_1, X_2 \geq 0$.

..3

4. a) Determine the initial basic feasible solution to the following transportation problem using Vogel's method.

Sources	Destinations				Supply
	D_1	D_2	D_3	D_4	
S_1	1	2	1	4	30
S_2	3	3	2	1	50
S_3	4	2	5	9	20
Demand	20	40	30	10	

OR

b) A sales person travels from one city to another city. The distances between pairs of cities are given below:

From	To			
	A	B	C	D
A	0	15	25	20
B	22	0	45	55
C	40	30	0	25
D	20	26	38	0

Suggest an optimal route to tea sales person, which enables him to visit each of the cities only once at the minimum total distance traveled.

..3

i) Draw a net work diagram

ii) Identify the critical path

iii) Determine the earliest starting and latest finishing time.

OR

b) A project has the following activities :

Activity	Time estimates (weeks)		
	t_0	t_m	t_p
0 – 1	6	7	8
1 – 2	8	12	16
1 – 3	6	9	12
2 – 3	3	4	5
1 – 4	5	9	13
3 – 4	6	9	18
4 – 5	10	13	16
5 – 6	4	7	10

i) Draw the PERT network diagram.

ii) What is the expected duration of the project ?

Code No. : 9012

6. a) A repairman is to be hired to repair machines which breakdown at an average rate of 6 per hour. The breakdowns follow Poisson distribution. The non-production time of a machine is considered to cost Rs. 20 per hour. Two repairmen, Mr. X and Mr. Y have been interviewed for this purpose. Mr. X charges Rs. 10 per hour and he services breakdown machines at the rate of 8 per hour Mr. Y demands Rs. 14 per hour and he services at an average of 12 per hour. Which repairman should be hired ? (Assume 8 hours shift per day).

OR

b) Solve the following game and determine the optimal strategies for both the players. Also determine the value of the game.

Player X	Player Y				
	Y_1	Y_2	Y_3	Y_4	Y_5
X_1	2	– 4	6	– 3	5
X_2	– 3	4	– 4	1	0

******