

- Answer any FIVE questions.
- Figures on the RHS indicate full marks.
- Support your answers with diagrams/illustrations and assumptions whenever necessary

1. (a) Solve the LPP by Dual Simplex method.

Min Z= 4X₁ +3X₂

s.t. X₁ +3X₂ ≥ 30, -X₁ +2X₂ ≥ 20, X₁, X₂ ≥ 0 (10)

(b) Solve the LPP using Branch & Bound algorithm.

Max Z= X₁ +X₂

s.t. 2X₁ +5X₂ ≤ 16, 6X₁ +5X₂ ≤ 30

X₁, X₂ are non-negative integers. (10)

2. (a) Write down the Dual problem for the following LPP.

Min Z= 5X₁ +3X₂ -4X₃

s.t. X₁ +X₂ +X₃ ≥ 5

2X₁ -5X₂ +X₃ = 6

X₁, X₂ ≥ 0, X₃ unrestricted (10)

(b) Solve the following Parametric programming problem:-

Max Z= 3X₁ +2X₂ +5X₃

s.t. X₁ +2X₂ +X₃ ≤ 30-7t

3X₁ +2X₃ ≤ 60+2t

X₁ +4X₂ ≤ 40-t

X₁, X₂, X₃, t ≥ 0 (10)

3. (a) Solve the LPP by Revised Simplex method

Min Z= 42X₁ +45X₂ +40X₃

s.t. X₁ +3X₂ +4X₃ ≥ 3, 2X₁ +2X₂ +4X₃ ≥ 2, X₁ +2X₂ +4X₃ ≥ 5

X₁, X₂, X₃ ≥ 0 (10)

(b) Six cities A, B, C, D, E and F are to be connected through ST bus routes.

Distance in kms are given below:

AB=4, AC=10, AD=3 BC=7 BD=4, BE=5, BF=6, CD=12, CE=8, DE=10,

DF=8, EF=9. Draw a NETWORK DIAGRAM and determine the optimal

routes connecting all cities. (10)

4. Determine the optimum solution to the following LPP:-

Max Z= 30X₁ +40X₂ +35X₃

s.t. 3X₁ +4X₂ +2X₃ ≤ 90, 2X₁ +X₃ +2X₃ ≤ 54, X₁ +3X₃ +2X₃ ≤ 93

X₁, X₂, X₃ ≥ 0

a) Find the change in the optimum solution if cost c₂ changes from 40 to 55

b) If the availability of resource R₁ increases by 20 what will be the new optimal solution.

c) A new constraint X₁ +2X₂ -X₃ ≤ 30 is added, find the new optimum solution. (20)



5. Maximize $Z = 30X_1 + 20X_2 + 25X_3$

s.t. $3X_1 + 2X_2 + X_3 \leq 120$ (supply of resource 1)

$5X_1 + 3X_2 + 4X_3 \leq 100$ (supply of resource 2)

Further it was possible to acquire more units of resources 1 and 2. Management would therefore prefer to buy excess units of resource 2.

The goods were set as to minimize

- i) Deviation from a target profit of Rs 2500
- ii) Additional units of resource 2 and
- iii) Additional units of resource 1

Formulate the problem as a Goal programming problem and solve it. (20)

6. (a) The following table gives activity duration in days and manpower requirement for a certain project. (10)

Activity	1-2	1-3	2-4	3-4	4-5
Duration	3	2	1	2	2
Manpower	4	3	2	5	4

Level out the resources without increasing the project duration.

- (b) The following table gives optimistic a, pessimistic b, and most likely m, durations, in days for a project: (10)

Activity	1-2	1-3	2-3	2-5	3-4	4-5
a	5	18	16	6	7	3
b	10	22	20	12	12	5
m	8	20	18	9	10	4

- (i) Determine expected duration and variance for each activity.
- (ii) Find the probability that the project will be completed 3 days later than the expected time.

7. For the network given below, the following table gives costs & times for the crash & schedules. (20)

Activity	1-2	1-3	1-4	2-4	2-5	3-4	4-5
Normal Days	3	2	6	5	7	2	4
Crashing Days	2	1	4	3	6	2	2
Normal Cost	50	75	140	100	115	80	100
Crashing Cost	100	150	260	180	145	80	240

If indirect cost is Rs.90/- per day, determine,

- i. the shortest completion period for the project & its project cost?
- ii. the project duration for minimum total cost.

8. (a) For the following project determine EST, EFT, LST, LFT critical path and its duration. (20)

Activity	1-2	1-3	2-5	3-4	4-5
Duration (days)	3	2	5	6	4

(b) Explain the following terms with illustration:

- i) Total Float
- ii) Gomery's cutting plane algorithm
- iii) Alternative optimal solution, Non feasible solution, Unbounded solution and degenerate solution.

Duration: 3 Hours

(MARKETING)

TOTAL MARKS: 100

- Answer any FIVE questions.
- Figures on the RHS indicate full marks.
- Support your answers with diagrams/illustrations and assumptions whenever necessary

1. (a) Solve the LPP by Simplex method

$$\text{Min } Z = 5X_1 + 10X_2 + 8X_3$$

$$\text{s.t. } 3X_1 + 5X_2 + 2X_3 \leq 60, X_1 + X_2 + X_3 \leq 18, 2X_1 + 4X_2 + 5X_3 \leq 100$$

$$X_1, X_2, X_3 \geq 0 \quad (10)$$

(b) Write down the Dual problem for the following LPP.

$$\text{Max } Z = -5X_1 - X_2 - 2X_3$$

$$\text{s.t. } 2X_1 + 3X_2 + X_3 \geq 10, X_1 - 2X_2 + 4X_3 = 20$$

$$X_1, X_2 \geq 0, X_3 \text{ unrestricted} \quad (10)$$

2. ABC Ltd. Manufactures' Tables and Chairs. They have just acquired a new workshop that can operate 48 hrs a week. Production of 1 Table requires 2 hrs and a Chair will require 3 hrs of production time. Each table will contribute Rs. 400/- to profit while a chair contributes Rs.850/-. The marketing department has determined the maximum demand of 15 tables and 10 chairs in a week. Formulate a LPP to maximize the total profit and solve it by Simplex method. (20)

3.

a. Solve the given LPP by Revised Simplex method.

$$\text{Max } Z = 5X_1 + 8X_2 + 7X_3 + 4X_4 + 6X_5$$

$$\text{s.t. } 2X_1 + 3X_2 + 3X_3 + 2X_4 + 2X_5 \leq 20,$$

$$3X_1 + 5X_2 + 4X_3 + 2X_4 + 4X_5 \leq 30$$

$$X_1, X_2, X_3, X_4, X_5 \geq 0 \quad (10)$$

b. Obtain an Integer solution for the following LPP.

$$\text{Max } Z = 7X_1 + 9X_2$$

$$\text{s.t. } -X_1 + 3X_2 \leq 6, 7X_1 + X_2 \leq 35$$

$$X_1, X_2 \geq 0 \text{ and Integers} \quad (10)$$

4. Solve the following Parametric LPP (20)

$$\text{Max } Z = (30+3t) X_1 + (40-2t) X_2 + 20X_3$$

$$\text{s.t. } 3X_1 + 3X_2 + X_3 \leq 20, 2X_1 + 4X_2 + 3X_3 \leq 30$$

$$6X_1 + X_2 + X_3 \leq 20, X_1, X_2, X_3 \geq 0, 0 \leq t \leq 30$$

5. Two products P1 and P2 are manufactured on two sequential machines M1 and M2. The following table gives machine times, in hrs per unit of the two products. The daily production quotas for P1 and P2 are 80 and 60 units respectively. Each machine runs 16 hrs a day. Overtime though not desirable may be used if necessary to meet the production quota. Formulate the problem as Goal programming problem and find the optimal solution. (20)

6. a. Solve the LPP by Dual Simplex method (10)

$$\text{Min } Z = 4X_1 + 3X_2 - X_3$$

$$\text{s.t. } X_1 + 3X_2 - 2X_3 \geq 20, -X_1 + 2X_3 + 4X_3 \geq 25, X_1, X_2, X_3 \geq 0$$

- b. State the advantage of Revised Simplex Method over standard simplex method (10)

7. (a) The following table gives activities duration in days and manpower requirement for a certain project. (10)

Activity	1-2	1-3	2-4	3-4	3-5	4-5
Duration	3	2	6	7	5	4
Manpower	2	3	1	3	2	3

Level out the resources without increasing the project duration.

- (b) For the following project determine EST, EFT, LST, LFT critical path and its duration. (10)

Activity	1-2	1-3	1-4	2-4	2-5	3-4	4-5
Duration (days)	3	2	6	5	7	2	4

8.

- a. For the network given below, the following table gives costs & times for the crash & schedules. (10)

Activity	1-2	1-3	2-4	3-4	4-5
ND	5	2	5	3	2
CD	2	1	3	1	1
NC	100	50	150	80	60
CC	250	80	180	120	70

Determine

- the shortest completion period for the project & its project cost?
- the project duration for minimum total cost.

- (b) The following table gives optimistic a, pessimistic b, and most likely m, durations, in days for a project: (10)

Activity	1-2	1-3	2-3	2-4	3-5	4-5
OPTIMISTIC TIME	5	15	16	8	7	3
MOST LIKELY TIME	9	20	21	12	10	6
PESSIMISTIC TIME	13	25	26	16	13	4

- Determine expected duration and variance for each activity.
- Find the probability that the project will be completed 4 days later than the expected time.

5

Duration: 3 Hours

(PRODUCTION)

TOTAL MARKS: 100

- i. Answer any FIVE questions.
- ii. Figures on the RHS indicate full marks.
- iii. Support your answers with diagrams/illustrations and assumptions whenever necessary

1. (a) Solve the LPP by Simplex method

$$\text{Min } Z = 30X_1 + 16X_2 + 25X_3$$

$$\text{s.t. } 8X_1 + 4X_2 + 5X_3 \leq 1000$$

$$5X_1 + 3X_2 + 3X_3 \leq 650$$

$$3X_1 + 2X_2 + 3X_3 \leq 420$$

$$X_1, X_2, X_3 \geq 0$$

(10)

(b) Write down the Dual problem for the following LPP.

$$\text{Min } Z = 2X_1 + 5X_2$$

$$\text{s.t. } X_1 + X_2 + 6X_3 \leq 6 \quad X_1 + X_2 \geq 2 \quad X_1 - X_2 + 3X_3 = 4$$

$$X_1, X_2, X_3 \geq 0$$

(10)

2. Ashok Pvt. Ltd. Manufactures' two products A and B. They have just acquired a new workshop that can operate 48 hrs a week. Production of one unit of product requires 2 hrs and that of B requires 3 hrs of production time. Each unit of Product A contributes Rs. 40/- to profit while that of B contributes Rs.85/-. The marketing department has determined the maximum demand of 150 units of A and 100 units of B in a week. Formulate a LPP to maximize the total profit and solve it by Simplex method. (20)

3. a. State the advantage of Revised Simplex Method over standard simplex method.(10)

b. Solve the LPP by Revised Simplex method

(10)

$$\text{Max } Z = 3X_1 + 5X_2 + 8X_3$$

$$\text{s.t. } 5X_1 + 3X_2 + 4X_3 \leq 20, \quad 2X_1 + 4X_2 + 5X_3 \leq 30$$

$$X_1, X_2, X_3 \geq 0$$

(10)

4. a. Solve the LPP by Dual Simplex method

(10)

$$\text{Min } Z = 3X_1 + 3X_2 + X_3$$

$$\text{s.t. } 2X_1 + X_2 + X_3 \geq 6, \quad X_1 + X_3 + 2X_2 \leq 8, \quad X_1, X_2, X_3 \geq 0$$

b. Two products P1 and P2 are manufactured on two sequential machines M1 and M2. The following table gives machine times, in hrs per unit of the two products.

The daily production quotas for P1 and P2 are 80 and 60 units respectively. Each machine runs 16 hrs a day. Overtime though not desirable may be used if necessary

to meet the production quota. Formulate the problem as Goal programming

problem.

(10)

Machine time in Hours		
Machine/Product	P1	P2
M1	5	3
M2	6	2

5. Determine the optimum solution to the following LPP:-

$$\text{Max } Z = 2X_1 + 3X_2$$

$$\text{s.t. } 3X_1 + X_2 \leq 22, \quad X_1 + 3X_2 \leq 26, \quad X_1, X_2 \geq 0$$

Find the change in the optimum solution if

- a) cost c_1 changes from 2 to 4
- b) b_1 changes from 22 to 20
- c) coefficient of X_1 in the constraints changes from (3 1) to (2 2).
- d) a new constraint $2X_1 + 2X_2 \leq 25$ is added. (20)

6. (a) The following table gives activities duration in days and manpower requirement for a certain project. (10)

Activity	1-2	1-3	2-4	3-5	4-5
Duration	2	3	1	2	3
Manpower	4	2	3	4	2

Level out the resources without increasing the project duration.

(b) Write short note on Project Crashing. (10)

7. For the network given below, the following table gives costs & times for the crash & schedules. (20)

Activity	1-2	1-3	2-3	3-4	4-5
ND	4	5	3	4	6
CD	2	3	2	1	2
NC	50	150	80	110	200
CC	100	170	110	260	275

Indirect cost is Rs. 60/day. What is the shortest completion period for the project & its project cost?

8. (a) For the following project determine EST, EFT, LST, LFT critical path and its duration. (10)

Activity	1-2	1-3	2-5	3-4	4-5
Duration (days)	3	2	5	6	4

(b) Explain the following terms with illustration: (10)

- i) Total Float
- ii) Gomery's cutting plane algorithm
- iii) Alternative optimal solution, Non feasible solution, Unbounded solution and degenerate solution.

N.B.: (1) Answer any five from the following. (2) Figures to the right indicate full marks.

[Total Marks : 100] Time: 3 hrs.

- 1. Differentiate between Q system (two bin system) and P system (PRS) with respect to Inventory management. (20)
- 2. Annual demand (units) and price per unit (Rs) of three items is given below. If ordering cost is Rs. 10, carrying cost is 12% and only Rs. 4500 are available per order cycle, find optimum order quantities under the finance restriction. Also compare this ordering policy with the one without having the finance restriction. (20)

Item	P	Q	R
Annual Demand	3600	24000	600
Price per unit	20	5	25

- 3. What is Dynamic programming? Explain how it differs from linear programming? (20)
- 4. From the following data recommend an optimum pricing strategy based on greater expected profit and higher chance of reaching the breakeven sales (20)

Variable and unit of measure	Notations for expected value and standard deviation	Alternatives		
		I	II	III
Price per unit(Rs)	E(p)	2.50	3.00	3.50
	σ_p	0.25	0.50	0.75
Variable cost per unit (Rs)	E(v)	2	2	2
	σ_v	0.5	0.5	0.5
Fixed cost (Rs)	E(f)	2,50,000	2,50,000	2,50,000
	σ_f	5,000	5,000	5,000
Sales quantity in units	E(q)	6,00,000	2,80,000	1,00,000
	σ_q	4,000	3,000	2000

- 5. Solve the following LPP by dynamic programming approach (20)
 Maximise $Z = 8x_1 + 7x_2$ subject to
 $2x_1 + 8x_2 \leq 8$
 $5x_1 + 2x_2 \leq 15$

$x_1, x_2 \geq 0$

- 6. If money is worth 18%, compounded bimonthly, find the amount of an annuity whose annual rent is Rs. 6000 which is payable bimonthly for 5 years. Also find its present value. (20)



7. Write short notes on (20)
[i] Decision Tree [ii] Howard's policy space technique

8. The ONGC has a piece of land under which it suspects an oil reserve. ONGC classifies such land into four categories by the total number of barrels that are expected to be obtained per day from the wells, namely 5 lac barrel well, 2 lac barrel well, 0.5 lac barrel well, dry well. These are therefore four states of nature. The company is faced with deciding whether to drill for oil, to unconditionally lease the land or conditionally lease the land at a rate depending upon the oil strike. These are three alternative courses of action. The cost of drilling a producing well is Rs. 1 lac and cost of drilling a dry well is Rs. 0.75 lacs. For producing well, the profit after deducting all production costs per barrel of oil is Rs. 1.50. Under the unconditional lease agreement the company can get Rs.0.45 lacs for the land whereas under the conditional lease agreement the company receives 50 Paise for each barrel strike. Otherwise it receives nothing. Draw the payoff table. The company had some experience with wells in similar geological areas and has concluded that about 10% of the strikes are 5 lac barrel well, 15% are 2 lac barrel well, 25% are 0.5 lac barrel well and 50% are dry wells. Carry out prior analysis and choose the best course of action. Also compute expected payoff of perfect information and the cost of working under uncertainty. (20)



(Section – B: PRODUCTION)

N.B.: (1) Answer any five from the following.
 (2) Figures to the right indicate full marks.

[Total Marks : 100]
 Time: 3 hrs.

1. Demand for 20 months of an item is as follows. Forecast demand for 21st to 24th months by single exponential smoothing with $\alpha = 0.8$ and $\alpha = 0.95$. Compute MSE in each case and comment. (20)

Month	1	2	4	5	6	7	8	9
Demand	85	76	55	72	53	50	36	38
Month	10	11	13	14	15	16	17	18
Demand	54	85	93	53	28	24	48	15
Month	19	20						
Demand	12	10						

2. Annual demand (units) and price per unit (Rs) of three items is given below. If ordering cost is Rs. 10, carrying cost is 12% and only Rs. 4500 are available per order cycle, find optimum order quantities under the finance restriction. Also compare this ordering policy with the one without having the finance restriction. (20)

Item	P	Q	R
Annual Demand	3600	24000	600
Price per unit	20	5	25

3. Following table gives processing times including average set up times for 6 books on 3 machines. If the books are processed on all machines in a common order. Determine optimum sequence with a view to minimising total make span time. (20)

Book	Time (in arbitrary unit) taken on machine		
	M1(Printing)	M2(Binding)	M3(Finishing)
1	5	8	20
2	6	30	6
3	30	4	5
4	2	5	3
5	3	10	4
6	4	1	4
Total	50	58	42

4. XYZ Tailoring House has one tailor specialised in men's shirts. The number of customers requiring stitching of shirts appears to follow Poisson distribution with mean arrival rate of 12 per hour. Customers are attended to by the tailor on FCFS basis and they are willing to wait for service if there be queue. The time the tailor takes to attend a customer is exponentially distributed with mean of 4 minutes. Calculate (i) Traffic intensity, (ii) The probability that the queuing system is idle (iii) The average time the tailor is free on 8-hour working day (iv) The probability that there will be 5 customers in the shop at a point of time. (v) The number of customers in the shop (vi) The expected number of customers waiting for tailor's service (vii) Expected length of non empty queue. (viii) Expected waiting time in queue (ix) Expected time a customer spends in system (x) Probability that customer shall wait for more than 10 minutes in the queue. (20)

[TURN OVER

- 5. Explain the concepts Balking, Collusion, Reneging, Transient and Steady state with respect to waiting line theory. (20)
- 6. What is machine interface? Explain Simple deterministic model for interface. Also discuss some applications of interface involved by management in industry. (20)
- 7. Solve the following programming problem (20)

Maximise $Z = -3x_1 + x_2 + 3x_3$ subject to

$$-x_1 + 2x_2 + x_3 \leq 4$$

$$2x_2 - 1.5x_3 \leq 1$$

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

$x_1, x_2 \geq 0, x_3$ non negative integer.

- 8. What is goal programming? Explain how it differs from linear programming? (20)



(Section – C: MARKETING)

- N.B.: (1) Answer any five from the following.
 (2) Figures to the right indicate full marks.

[Total Marks : 100]
 Time: 3 hrs.

1. What is Dynamic programming? Explain how it differs from linear programming? (20)
2. The Dason & Co. has been offered a Rs.10,000 study contract to refine a device for reducing automobile exhaust emissions. Following the study contract, there will be awards for prototype product contract for a few preliminary models and then awards for regular production contracts. Mr. Dason has decided to consider two levels of effort high and low on the study contract with following details. (20)

Aspect	Level of effort on study contract	
	High	Low
Estimated cost	Rs.15000	Rs. 5000
Chance of winning prototype contract	0.6	0.4

Dason's probability of winning the production contract with gross profit of Rs. 50,000 (limited by Dason's available production facilities), depends upon the level of effort on the study contract plus its level of effort on the prototype contract, if one is received. Two levels of efforts, high at an estimated cost of Rs. 10,000 and low at an estimated cost of Rs. 6,000 have been considered for the prototype contract. If Dason received a production contract the profit will be decreased because of additional production expenses incurred unless a high level of effort was employed on the prototype contract. The information is given below.

Study Contract Level of effort	Prototype Contract Level of effort	Prob. Of winning production contract	Additional production expenses (Rs)
LOW	High	0.7	0
	Low	0.5	5,000
	None ^s	0.1	15,000
HIGH	High	0.8	0
	Low	0.6	5,000
	None*	0.2	15,000

*Prototype contract not received.

Use Decision Tree approach to determine the optimal strategy and specify it completely together with its expected value. (20)

3. Annual demand (units) and price per unit (Rs) of three items is given below. If ordering cost is Rs. 10, carrying cost is 12% and only Rs. 4500 are available per order cycle, find optimum order quantities under the finance restriction. Also compare this ordering policy with the one without having the finance restriction. (20)

Item	P	Q	R
Annual Demand	3600	24000	600
Price per unit	20	5	25

4. What is Bayesian approach? Explain three steps in Bayesian approach in detail. (20)

5. Demand for 20 months of an item is as follows. Forecast demand for 21st to 24th months by single exponential smoothing with $\alpha = 0.8$ and $\beta = 0.95$. Compute MSE in each case and comment. (20)

Month	1	2	4	5	6	7	8	9
Demand	85	76	55	72	53	50	36	38
Month	10	11	13	14	15	16	17	18
Demand	54	85	93	53	28	24	48	15
Month	19	20						
Demand	12	10						

6. Differentiate between Q system (two bin system) and P system (PRS) with respect to inventory management. (20)
7. What is forecasting? Explain forecasting models in detail. (20)
8. Solve the following programming problem (20)

Maximise $Z = -3x_1 + x_2 + 3x_3$ subject to

$$-x_1 + 2x_2 + x_3 \leq 4$$

$$2x_2 - 1.5x_3 \leq 1$$

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

$$x_1, x_2 \geq 0, x_3 \text{ non negative integer.}$$

Con. 259-16.

BO-4887

(3 Hours)

[Total Marks : 100

Instructions:

- Attempt any **FIVE (5)** questions.
- All questions carry equal marks.

1. Discuss various operating systems in detail.
2. Explain the concepts of DBMS and RDBMS in detail.
3. (a) What do you mean by File Processing ?
(b) Explain Query languages.
4. (a) What is an operating system? Discuss its need and also compare the various operating systems available.
(b) Write the features of C programming language .
5. Discuss the various techniques and models of simulation.
6. Discuss the uses, advantages, disadvantages and limitations of temporary and permanent storage devices in computer systems.
7. What is the role of computers in Operations Research?
8. Write short notes on:
 - (a) MIS
 - (b) DSS
 - (c) ERP
 - (d) Application Software

(3 Hours)

[Total Marks : 100

Integrated Approach to operation Research

- N.B.: (1) Question 1 is compulsory and attempt any four from the rest.
 (2) Real life examples will receive more weightage.
 (3) Answer must be brief and to the point.
 (4) Figures to the right indicate full marks.

(Paper-IB)

1. Malcolm Baldrige National Quality Award developed by USA as a model for Business Excellence. It is based on following criteria. (i) Leadership, (ii) Strategic Planning, (iii) Customer and Market focus, (iv) Measurement analysis and Knowledge Management, (v) Human resource Focus, (vi) Process Management, (vii) Results. Write the contribution of OR techniques while addressing each of the above seven criteria. (20)

OR

Write contribution of OR techniques to achieve breakthrough improvements in Educational Institutions or any other service industry you are familiar with. (20)

2. (a) Explain concept of Decision Support Systems and the role of OR in their development. (10)

(b) Highlight synergies between decision support systems and Information Systems towards overall improvement of bottom line of an organization. (10)

3. (a) List out ten OR techniques and provide at least one application area for each of the techniques in Industry, Business, Marketing and Administration. (10)

(b) Describe various elements of MIS (Management Information System) and their linkages with particular reference to a large project management. (10)

4. (a) What do you mean by Policy planning, Strategic planning and Operational planning? Differentiate between three levels by means of real life examples. (10)

(b) Highlight basic principles of Strategic Management and contribution of OR department in their fulfilment. (10)

5. (a) Mr. X wants to set up and run an industry. As an advisor at senior level how will you guide Mr. X in decision making areas with their functions where Operation Research or other Quantitative Methods can be applied. (10)

(b) Categorise above techniques into Strategic, Tactical and Operational decisions. (10)

6. (a) Explain the application of OR in and Resource Planning. (10)

(b) Discuss the relationship between theory and practice in different stages of a typical OR study. Illustrate. (10)

7. Write short notes on any Four of the following. (20)

- (a) Management Information System.
- (b) Application of OR in Environmental Scanning
- (c) Critical success factors of OR.
- (d) Relationship of OR and OHSAS.
- (e) Satisficing, Optimising and Adaptising.
- (f) Application of OR in Variety reduction.
