

IV B.Tech. II-Semester Supplementary Examinations, April/May-2005
OPERATIONS RESEARCH
(Chemical Engineering)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. Outline broad features of the judgment phase and the research phase of scientific method in Operations research. Discuss fully any one of these phases.
2. (a) Explain the use of artificial variable and its use in linear programming.
 (b) An animal feed company must produce 200 Kg of a mixture containing of ingredients A and B respectively. Ingredient A Costs Rs. 3/- per Kg. And B costs Rs. 8/- per Kg. No more than 80 Kg of A can be used and at least 60 Kg of B must be used. Find how much of each ingredients should be used if the company wants to minimize cost.
3. Five jobs, each of which must go through the machines A, B and C in the order BAC:

Processing times in hours					
Job no.	(1)	(2)	(3)	(4)	(5)
Machine A	3	2	5	6	4
Machine B	6	8	7	10	6
Machine C	4	8	6	7	8

Determine a sequence for the jobs that will minimizes the total elapsed time.

4. The following mortality rates have been observed for a certain type of bulbs:

End of week:	1	2	3	4	5	6
Probability of failure to date	0.09	0.25	0.49	0.85	0.97	1.00

5. A and B play a game in which each has three coins 5 paise, 10 paise and 20 paise, each selects a coin without the knowledge of other's choice. If the sum of coins is an odd amount, A wins B's coin, if the sum is even B wins A's coin. Find the best strategies for each player and the value of the game.
6. (a) What is a queuing problem? Explain queuing system, transient and steady state.
 (b) What is a queue? How are they classified? Explain each briefly.
7. A shopkeeper has a uniform demand of an item at the rate of 50 items / month. He buys from a supplier at a cost of Rs. 6 per item and the cost of ordering is Rs. 10 /- each time. If the stock holding costs are 20 % year of stock value. How frequently should he replenish his stocks? Now suppose the supplies offers 5% discount on orders between 200 and 999 items and a 10 % discount on orders exceeding or equal to 1000 can the shop keeper reduce his costs by taking advantage of either of these discounts.

8. (a) Briefly discuss the applications of dynamic programming.
(b) Solve the following problem by using dynamic programming.
Max. $Z = x_1 + 9x_2$ Subject to: $2x_1 + x_2 \leq 25, x_2 \leq 11, x_1, x_2 \geq 0$

IV B.Tech. II-Semester Supplementary Examinations, April/May-2005
OPERATIONS RESEARCH
(Chemical Engineering)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. Discuss the advantages and disadvantages or limitations of using results from a mathematical model to make decisions about operations.
2. (a) A retail store stocks two types of shirts A and B. These are packed in attractive cardboard boxes. During a week the store can sell a maximum of 400 shirts of type A and a maximum of 300 shirts of type B. The storage capacity, however, is limited to a maximum of 600 shirts of both types combined. Type A fetches a profit of Rs. 20 per unit and the B a profit of Rs. 50/- per unit. How many of each type the store should stock per week to maximize the total profit. Formulate the mathematical model of the above problem and solve it graphically.
 (b) Write the dual of the above problem and solve it by Simplex method and give the answer of the primal from the dual solution.
3. A book binder has one printing press, one binding machine, and the manuscripts of a number of different books. The cost of the printing and binding operations for each book are known. Determine the order in which books should be processed, in order to minimize the total production cost.

Book	Printing cost (Rs.)	Binding cost (Rs.)
1	550	45
2	1400	120
3	800	75
4	350	45
5	1250	100
6	600	50

4. A hand grinding machine (Type A) costs Rs 9500. Annual operating costs are Rs 220 for the first year and it increases by Rs.1900 every year. Find the optimal age at which the hand-grinding machine of type A is to be replaced. Assume that the machines have no resale value and future costs are not discounted. Another hand grinding machine (type B) costs Rs.10, 500/-. Annual operating costs are Rs 410/- for the first year and it increases by Rs. 820 every year. You have one hand-grinding machine of type A, which is one year old. Should you replace it with hand grinding machine of type B and if so when?
5. Two players A and B play the following game. A has a bag containing three coins, one worth 1 unit, one 3 units and the rest worth 6 units. A takes one coin from the bag and before it is exposed, B guesses what it is? If B guesses rightly, he takes the coin, if he is wrong, he gives to A a coin of the same worth. Find the best sorting and value of the game. Contd.2

6. (a) Explain the real world situation, where queuing can be applied.
(b) Explain service pattern and traffic intensity.
7. A certain item has an annual demand of 2000 units. The cost of placing an order is Rs. 400 & the annual carrying cost is Rs. 10/unit. The costs of stocks are estimated to average Rs. 10. The demand during lead time tends to be randomly distributed through out the year. So that a poisson distribution may be assumed. These are 250 working days/year and lead time is 5 working days.

Demand during lead time:	70	75	80	85	90	95	100
Probability :	0.02	0.14	0.23	0.24	0.21	0.12	0.04

Determine the optimal order quantity and re order level.

8. (a) Define the following terms in dynamic programming
- State
 - State variable
 - Immediate return
- (b) Find the minimum value of $z = y_1^2 + y_2^2 + \dots + y_n^2$ subject to the constraints:
 $y_1 y_2 y_3 y_n = c$ and $y_j \geq 0$ for $j = 1, 2..n$

IV B.Tech. II-Semester Supplementary Examinations, April/May-2005
OPERATIONS RESEARCH
(Chemical Engineering)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. What is a decision? What are its characteristics? Explain how guesswork will be more useful than scientific methods while making decisions by giving examples of your choice.
2. (a) Explain the following and mention why they are used and what is the physical interpretation.
 - i. Artificial Surplus Variable,
 - ii. Surplus variable
 - iii. Slack variable.
- (b) A farmer has to plant two kinds of trees, A and B in a land of 4400 m² area. Each of tree A requires at least 25 m² and B requires at least 40 m² of land. The annual water requirement of A is 30 units and that of B is 15 units per tree, while at most 3300 units of water is available. It is also estimated that the ratio of the number of B trees to the number of A trees should not be less than 6 / 19 and not more than 17 / 8. The return from A trees is expected to be one and half times as much as that from B trees. What should be the number of trees of each kind so as to expected return is maximum? Formulate the problem and solve it by Simplex method.
3. State the conditions under which the problem of processing of n jobs through m machines has been solved. Find the sequence that minimizes the total time required to complete the following tasks. The tasks must be performed in the order Machine III - Machine I - Machine II.

Task	A	B	C	D	E	F	G
Machine I	2	4	3	6	4	5	3
Machine II	10	7	8	6	9	8	7
Machine III	5	8	6	12	7	6	10

4. A machine costs Rs.12000 when new. The running costs are Rs.1920/- for the first 5 years, increasing by Rs.480/- per year thereafter. Assuming a 10
5. (a) Explain dominance property.
- (b) Solve the following game.

		Player B				
		I	2	2	3	-1
Player I	II	4	3	2	6	

6. (a) Explain different queuing system with examples.
(b) What are the limitations of queuing model in its application?
7. A baking company sell cake by Kg weight. It makes a profit of Rs. 5 /kg on each Kg. Sold on each day it is baked. It disposes of all cakes not sold on the date it is baked at a loss of Rs. 1.20/ kg. If demand is known to be rectangular between 2000 x 3000 Kg. Determine optimal daily amount baked.
8. (a) What is dynamic programming and what sort of problems can be solved by it?
(b) Solve the following linear programming problem by using dynamic programming technique $Maxz = 3x_1 + 5x_2$ Subject to the constraints : $x_1 \leq 4; x_2 \leq 6; 3x_1 + 2x_2 \leq 18; x_1, x_2 \geq 0$.

★ ★ ★ ★ ★

IV B.Tech. II-Semester Supplementary Examinations, April/May-2005
OPERATIONS RESEARCH
(Chemical Engineering)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. Discuss three types of models with special emphasis on their important logical properties and the relationship they bear to each other.
2. A transport company with Rs. 40,00,000 to spend is contemplating to purchase three types of vehicles. Vehicle A has 10 tons pay load and expected to average 35 Km. per hour and it costs Rs. 80,000. Vehicle B has 20 ton pay load, expected to average 30 Km per hour and costs Rs. 1,00,000. Vehicle C is modified form of B. It is having provisions for sleeping for one driver and its capacity is 18 tons and averages to 28 Km per hour. A and B with one driver can run 12 hours per day. C requires 2 drivers and runs 20 hours per day. Company has 100 drivers available. Maintenance facilities restrict the total vehicle to 30. Formulate this as a linear programming problem to maximize ton kms . Write starting simplex tableau. Carry out only two iterations.
3. Solve the following sequencing problems:

Processing times in hours				
Job no.	M_1	M_2	M_3	M_4
Machine A	13	7	8	14
Machine B	12	8	6	19
Machine C	9	5	7	15
Machine D	8	6	5	15

4. A grinding machine costs Rs.10000/- when new. The operating costs are Rs.500/- per year for first 5 years, in the sixth and following years the operating costs increases by Rs.100/- per year. Assuming a 10% discount rate of money per year, find the optimum length of time to hold the machine before we replace it.
5. Two children play the following game named "scissors, paper, stone". Both players simultaneously call one of the three- scissors, paper or stone. Scissors beat paper (as scissors cuts papers)., paper beats stone (as stone can wrapped in paper) and stone beats scissors(as stone can blunt scissors). There is a tie if both call the same thing if there is one point for win, Zero for the tie and -1 for the loss, form the payoff matrix of the game and solve it and give the optimal strategies of the players and the value of the game.
6. (a) Describe the fundamental components of a queuing process and give suitable examples.
 (b) Explain briefly the main characteristics of a queuing system.

7. (a) Consider an item on which incremental quantity discounts are available. The first 100 units costs Rs. 100/- each & additional units costs Rs. 95/- each . Determine the optimal order quantity Q if $K = 600$ units / year. $I = 0.20$, $C_3 = \text{Rs. } 50/\text{ set up}$
- (b) Describe the basic Characteristics of inventory system
8. (a) State the principle of optimality in dynamic programming.
- (b) Solve the following linear programming problem by using dynamic programming technique. $Max z = 8x_1 + 7x_2$
Subject to the constraints : $2x_1 + x_2 \leq 8$, $5x_1 + 2x_2 \leq 15$; $x_1, x_2 \geq 0$.
