OPERATIONS RESEARCH (SEMESTERS - 2 & 4)

CS/MBA (O)/SEM-2 (FT) & 4 (PT)/MB-205/09
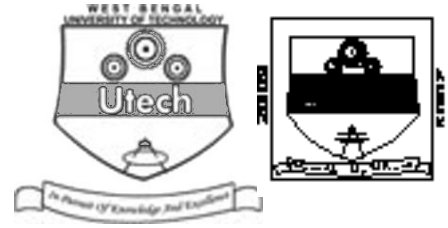
1. ....
   Signature of Invigilator

2. ....
   Signature of the Officer-in-Charge

Reg. No.

Roll No. of the Candidate

CS/MBA (O)/SEM-2 (FT) & 4 (PT)/MB-205/09
ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
OPERATIONS RESEARCH (SEMESTERS - 2 & 4)

Time : 3 Hours]   [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **40 pages**. The questions of this concerned subject commence from Page No. 3.

2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.

   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.

3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.

4. Read the instructions given inside carefully before answering.

5. You should not forget to write the corresponding question numbers while answering.

6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.

7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**

8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.

9. Rough work, if necessary is to be done in this booklet only and cross it through.

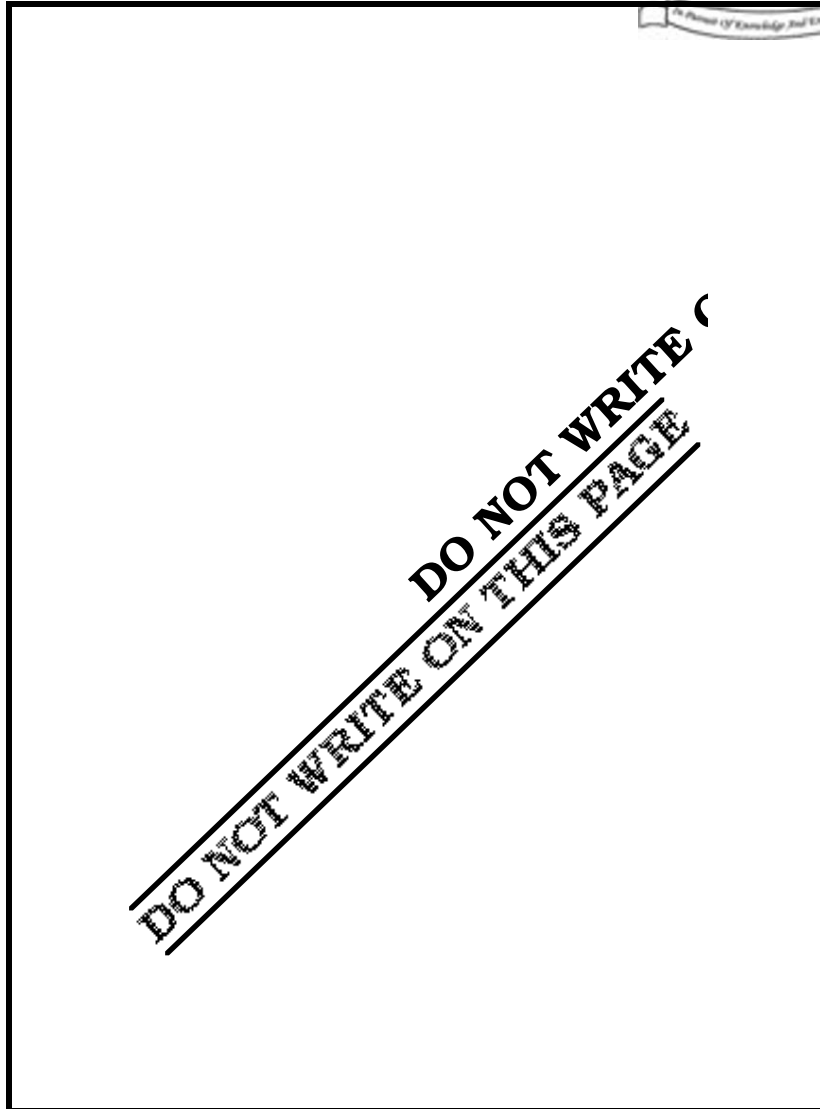### No additional sheets are to be used and no loose paper will be provided

FOR OFFICE USE / EVALUATION ONLY
Marks Obtained

					Group – A						Group – B			Group – C				Total Marks	Examiner's Signature
Question Number																			
Marks Obtained																			

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Head-Examiner/Co-Ordinator/Scrutineer

51007 (02/06) (O)

DO NOT WRITE ON THIS PAGE

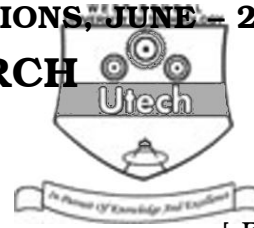## ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
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Graph sheets are provided at the end of the booklet.

GROUP – A

(Multiple Choice Type Questions)

1.   Choose the correct alternatives for any *ten* of the following :   10 × 1 = 10

    i)   The concept of 'loop' is used in

        a)   transportation problem   b)   assignment problem

        c)   queuing problem   d)   none of these.

    ii)   In LPP, feasible solution regions are restricted by

        a)   negative restriction   b)   positive restriction

        c)   non-negative restriction   d)   none of these.

    iii) An assignment problem can be solved by

        a)   Hungarian method   b)   VAM

        c)   Matrix minima method   d)   None of these.

    iv)   What is the method to solve an LPP involving artificial variables ?

        a)   Simplex method   b)   Charnes-M-method

        c)   VAM   d)   None of these.

    v)   The optimality condition for minimization LPP in the simplex method is

        a) $Z_j - C_j \geq 0 \ \forall j$ b) $Z_j - C_j \leq 0 \ \forall j$

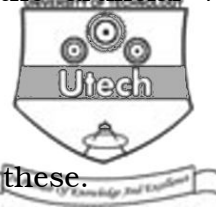   c) $Z_j - C_j < 0 \ \forall j$ d)   none of these.

vi) For a a maximization problem the coefficient of the artificial variable in the objective function of an LPP is

a) M

b) $-M$

c) 0

d) none of these.

vii) The point of intersection of pure strategies in a game is called

a) value of the game

b) Saddle point

c) mixed strategy

d) optimal strategy.

viii) The value of the game having the following pay-off matrix is

	B_1	B_2	B_3
A_1	10	2	3
A_2	7	6	8
A_3	0	3	1

a) 6

b) 10

c) 8

d) 2.

ix) The EOQ formula under lot size model without shortage is

a) $\sqrt{\dfrac{2C_3}{C_1 R}}$

b) $\sqrt{\dfrac{2 C_3 R}{C_1}}$

c) $\sqrt{\dfrac{2 C_3 \sqrt{R}}{C_1}}$

d) $\sqrt{\dfrac{2C_3}{C_1}}$.

x) Given a system of m simultaneous equations in n unknowns ($m < n$) the number of basic variables will be

a) m

b) n

c) $m - n$

d) $m + n$.

xi) In an assignment problem involving four workers and three jobs, the total number of assignments possible are

a) 4

b) 3

c) 7

d) 21.

xii) In $\{ (M / M / 1) : (\infty / FIFO) \}$ average length of a non-empty queue is

a) $\dfrac{\lambda^2}{\mu(\mu - \lambda)}$

b) $\dfrac{\mu}{\mu - \lambda}$

c) $\dfrac{\lambda \mu}{(\mu - \lambda)^2}$

d) none of these.

xiii) In a flow pattern $\sum f_{tA} = \sum f_{At}$ when the vertex A is

a) arbitrary vertex

b) any vertex other than source

c) source

d) none of these.

xiv) A sequencing problem involving six jobs and three machines require evaluation of

a) $(6 ! + 6 ! + 6 !)$ sequences

b) $(6 !)^3$ sequences

c) $(6 \times 6 \times 6)$ sequences

d) $(6 + 6 + 6)$ sequences.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following questions. $3 \times 5 = 15$

2. The final product of a firm has a requirement that it must weigh exactly 150 kg. The two raw materials used for manufacture of this product are R1 with a cost of Rs. 2 per unit and R2 with a cost of Rs. 8 per unit. Each unit of R1 weighs 5 kg and each unit of R2 weighs 10 kg. At least, 14 units of R2 and not more than 20 units of R1 must be used. Formulate the LPP.

3. Find the basic solution or solutions, if there be any, of the set of equations :

$2x_1 + 4x_2 - 2x_3 = 1$

$10x_1 + 3x_2 - 7x_3 = 33.$

4. Solve the assignment problem :

	1	2	3
A	7	5	6
B	8	4	7
C	9	6	4

5. Find the initial basic feasible solution of the following transportation problem by North-West corner method :

	W1	W2	W3	W4	Capacity
F1	10	30	50	10	7
F2	70	30	40	60	9
F3	40	8	70	20	18
Requirement	5	8	7	14	34

6. Solve the following problem graphically or otherwise :

		B		
A	1	2	– 3	7
	2	5	4	– 6

7. An aircraft company uses rivets at an approximately constant rate of 5000 kg per year. The rivets cost Rs. 20 per kg and the company personnel estimate that it costs Rs. 200 to place an order and the carrying cost of inventory of 10% per year.

   a) How frequently should orders for rivets be placed, and what quantities should be ordered for ?

   b) If the actual costs are Rs. 500 to place an order and 15% for carrying cost, the optimal policy would change. How much is the company losing per year because of imperfect cost information ?

8. A TV repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in and if the arrival of sets is approximately Poisson with an average rate 10 per 8-hour day, what is repairman's expected idle time each day ? How many jobs are ahead of the average set just brought in ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following questions.   3 × 15 = 45

9.   a)   Three persons are being considered for three open positions. Each person has been given a rating for each position as shown in the following table :

Position Person	1	2	3
1	7	5	6
2	8	4	7
3	9	6	4

Assign each person to one and only one position in such a way that the sum of ratings for three persons is maximum.   7

b)   Solve the following game problem :   8

dia

10. a)   Arrivals at telephone are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of phone call is assumed to be distributed exponentially with mean 3 minutes.

i)   What is the probability that a person arriving have to wait ?

ii)   What is the average length of the non-empty queue that forms from time to time ?

iii)   What is the probability that queue size exceeds 5 ?

iv)   The telephone department will instal a new booth if convinced that an arrival would expect waiting for at least 3 minutes for a phone call. By how much should the flow of arrivals increase in order to justify a second booth ?   2 + 2 + 2 + 2

8

b) Solve the game :

dia

7

11. Find the shortest distance from a to f by using Floyd's Algorithm. 15

dia

12. a) The annual requirement of a product is 3000 units. The ordering cost is Rs. 100 per order. The cost per unit is Rs. 10. The carrying cost per unit per year is 30% of the unit cost.

    i) Find EOQ.

    ii) By using better organizational method the ordering cost per order is brought down to Rs. 80 per order but the same quantity as determined above was ordered. If a new EOQ is found by using the order cost Rs. 80, what would be the further savings ? 4 + 3

b) Solve the Transportation problem : 8

dia

13. Solve the integer programming problem :   15

$$\text{Max.} \qquad Z = 7x_1 + 9x_2$$

$$\text{subject to} \qquad -x_1 + 3x_2 \leq 6$$

$$7x_1 + x_2 \leq 35$$

$x_1, x_2 \geq 0$ are integers.

14. a) Find the dual of the following LPP and hence solve it :   3 + 6

$$\text{Max.} \qquad Z = 3x_1 - 2x_2$$

$$\text{subject to} \qquad x_1 \leq 4$$

$$x_2 \leq 6$$

$$x_1 + x_2 \leq 5$$

$$-x_2 \leq -1$$

$x_1, x_2 \geq 0.$

b) We have five jobs, each of which must go through the two machines A and B in the order AB. Processing times in hours are given in the table below :

dia

Determine a sequence for the five jobs that will minimize the elapsed time.   6

15. a) A company has three plants at locations A, B and C which supply to warehouses located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400 500, 400 and 800 units respectively. Unit transportation costs (in Rupees) are given in the following table. Determine an optimal distribution for the company in order to minimize the total transportation cost.   10

dia

b) Find the optimal assignments to find the minimum cost for the assignment problem with the following cost matrix. 5

dia

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END