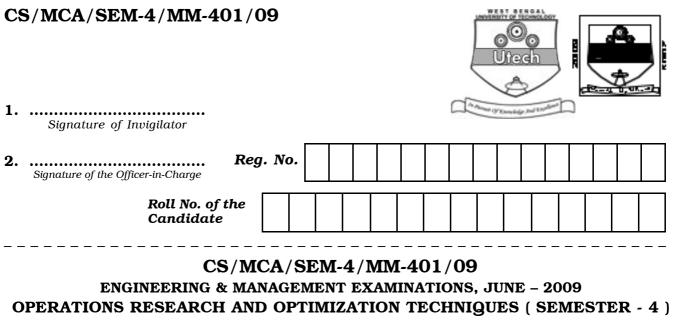
OPERATIONS RESEARCH AND OPTIMIZATION TECHNIQUES (SEMESTER - 4)



Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

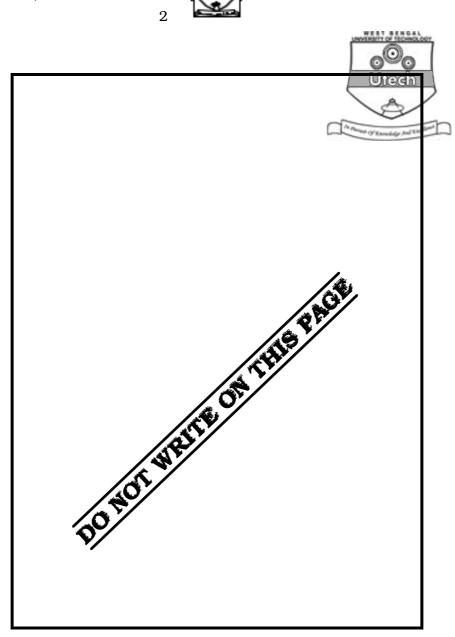
- 1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **40 pages**. The questions of this concerned subject commence from Page No. 3.
- 2. a) In **Group A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
 - 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				Gro	up –	В	Gro	up -	- C		
Question Number													Total Marks	Examiner's Signature
Marks Obtained														

Head-Examiner/Co-Ordinator/Scrutineer







3

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE - 2009 OPERATIONS RESEARCH AND OPTIMIZATION TECHNIQUES **SEMESTER - 4**

Time: 3

1.

e : 3 H	lours]		Full Marks :	70
		Graph sheets are provided	at the	e end of the booklet.	
		GROU	P – A		
		(Multiple Choice	Туре	Guestions)	
Cho	ose th	e correct alternatives for any te	en of tl	ne following : $10 \times 1 =$	10
i)		en a system of m simultaneou ober of basic variables will be	ıs equ	ations in n unknowns ($m < n$), r	the
	a)	m	b)	n	
	C)	<i>m</i> – <i>n</i>	d)	m + n.	
ii)	A tw	70-person zero-sum game is sai	d to be	e fair if	
	a)	both the players have equal r	umbe	r of strategies	
	b)	the game has a saddle point			
	c)	the game does not have a sad	ldle po	int	
	d)	the value of the game is zero.			
iii)		n assignment problem involv aber of assignments possible is	ring fo	ur workers and three jobs, the to	otal
	a)	4	b)	3	
	c)	7	d)	21.	
iv)	In {	$(M/M/1): (\infty/F/FO)$, avera	age len	gth of a non-empty queue is	
	a)	$rac{\lambda^2}{\mu (\mu - \lambda)}$	b)	$\frac{\mu}{\mu - \lambda}$	
	c)	$\frac{\lambda\mu}{(\mu - \lambda)^2}$	d)	none of these.	
V)	In a	flow pattern $\Sigma f_{tA} = \Sigma f_{At}$ when	the v	ertex A is	
	a)	arbitrary vertex	b)	any vertex other than source	
	c)	source	d)	none of these.	

CS/MCA/SEM-4/MM-401/09

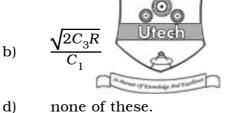


4 The formula for finding the minimum inventory cost under the purchasing model vi) without shortage is

b)

a)
$$\sqrt{2RC_1C_3}$$

c)
$$\frac{\sqrt{C_1}}{2RC_3}$$



A simplex in two dimension is vii)

- rectangle b) line segment a) c) triangle d) pentagon.
- When a positive quantity R is divided into five parts, the maximum value of their viii) product is

a)	5k	b)	($k/5$) 5
c)	(k5) ⁵	d)	5 (k/5).

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

- b) $Z_J C_J \le 0$ a) $Z_J - C_J \ge 0$
- c) $Z_J C_J < 0$ d) none of these.

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

- Simplex method b) Charnes M method a)
- None of these. VAM d) c)

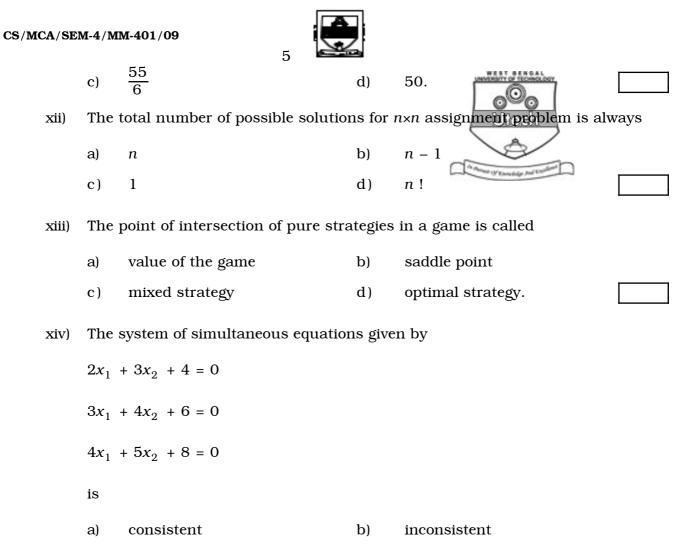
Consider the following game : xi)

		-		
Player (B)		1	2	3
	1	5	50	50
	2	1	1	0.1
	3	10	1	10

Player (A)

Then the value of the game is

a)
$$\frac{10}{3}$$
 b) $\frac{50}{7}$



c) possessing unique solution d) none of these.

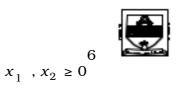
GROUP – B (Short Answer Type Questions)

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

2. Solve the following LPP by graphical method :

Minimize
$$Z = 20 x_1 + 10 x_2$$

Subject to
$$x_1 + 2 x_2 \le 40$$
$$3x_1 + x_2 \ge 30$$
$$4x_1 + 3x_2 \ge 60$$



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

- i) What is the prolability that a person arriving at the booth will have to wait ?
- ii) The telephone department will install a second booth when 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 ?
- iii) What is the average length of the queue that forms time to time ?
- 4. Find the optimal strategies and the value of the game *G* whose pay-off matrix is

	Player B				
Player A	- 2 6				
	5	1			

5. There are five jobs, each of which is to be processed through two machines M_1 and M_2 in the order M_1 M_2 . The processing hours are the following :

Jobs	1	2	3	4	5
M_{1}	3	8	5	7	4
M_2	4	10	6	5	8

Determine the optimal sequence of the five jobs, the minimum elapsed time and the ideal times for the machines $M_1\,$ and $M_2\,$.

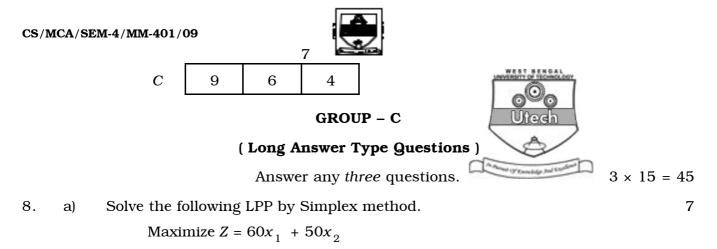
6. Find the basic solution or solutions, if there be any, of the set of equations

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

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

7. Solve the assignment problem :

	1	2	3
Α	7	5	6
В	8	4	7



subject to

$$\begin{aligned} x_1 + 2x_2 &\leq 40 \\ 3x_1 + 2x_2 &\leq 60 \\ x_1 &, x_2 &\geq 0 \end{aligned}$$

b) Solve the following linear programming problem by Charnes Big M method (if possible) :

Maximize $Z = 2x_1 - x_2 + 5x_3$

subject to

$$\begin{array}{l} x_1 + 2x_2 + 2x_3 \leq 2 \\ \\ \frac{5}{2} x_1 + 3x_2 + 4x_3 = 12 \\ \\ 4x_1 + 3x_2 + 2x_3 \geq 24 \\ \\ \text{and } x_1 \ , x_2 \ , x_3 \geq 0 \end{array}$$

What is the optimal value of Z?

9. a) Write down the dual of the following LPP :

Minimize $Z = 3x_1 + x_2$

subject to

$$\begin{aligned} &2x_1 + x_2 \geq 14, \\ &x_1 - x_2 \geq 4, \ x_1 \ , x_2 \geq 0, \end{aligned}$$

and solving the dual problem find out the optimal solution and the optimal value of the objective function.

b) Find the optimal solution to the following integer programming problem : 7 Maximize $Z = x_1 - x_2$

4617 (12/06)

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8 subject to $x_1 + 2x_2 \le 4$,

 $6x_1 + 2x_2 \le 9, x_1, x_2 \ge 0$ and

 x_1 , x_2 are integers.

10. Solve the following balanced Transportation Problem : a)

	D_1	D_2	D_3	D_4	Capacity
F1	2	3	11	7	6
F2	1	0	6	1	1
F3	5	8	15	9	10
Requirement	7	5	3	2	17

b) Use dynamic programming to solve the following problems :

Minimize $Z = y_1^2 + y_2^2 + y_3^3$ subject to $y_1 + y_2 + y_3 \ge 15$

and y_1 , y_2 , $y_3 \ge 0.$

Solve the following two-person-zero game using the method of dominance : 11. a) 8

		Player B									
	5	- 10	9	0							
Player A	6	7	8	1							
	8	7	15	1							
	3	4	- 1	4							

b) Find the optimal assignments to find the minimum cost for the assignment 7 following cost matrix :

	J1	J2	J3
P1	12	24	15
P2	23	18	24
Р3	30	14	28

Use dynamic programming to solve 12.

> $Z = Y_1$, Y_2 , Y_3 Maximum

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8



Subject to constraints

 $Y_1 + Y_2 + Y_3 = 5$

9

and \boldsymbol{Y}_1 , \boldsymbol{Y}_2 , $\boldsymbol{Y}_3 \geq \boldsymbol{0}.$

b) The following information is given :

Activity	1 – 2	2 – 3	2 – 4	3 – 5	4 - 6	5 – 6	5 – 7	6 – 7
Pessimistic	3	9	6	8	8	0	5	8
time (weeks)								
Most likely	3	6	4	6	6	0	4	5
time (weeks)								
Optimistic	3	3	2	4	4	0	3	3
time (weeks)								

Draw the network diagram for the above. Calculate

- i) Variance of each activity
- ii) Critical path and expected project length
- iii) The probability that the project will be completed in 23 weeks.

Given :

Z-value	1.9	1.91	1.92	1.93	1.94
Probability	0.9713	0.9719	0.9726	0.9732	0.9738

4 + 2 + (2 + 1) + 4

14. a) Assuming that the expected times are normally distributed, find the probability of meeting the schedule date for the given network :

Job	1 - 2	1 - 3	2 - 4	3 - 4	4 - 5	3 - 5
t _o	2	9	5	2	6	8

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		10			
t _m	5	12	14	5	17
t_p	14	15	17	12 Utech 2	20

Schedule project completion date is 30 days. Also find the date on which the project manager can complete the project with a probability of 0.90.

b) A small project consists of seven activities for which the relevant data are given :

Activity	Immediate predecessors	Time (days)		
А	_	2		
В	_	1		
С	А	3		
D	A, B	2		
E	C, D	1		
F	B, D	3		
G	E, F	1		

i) Draw the network diagram.

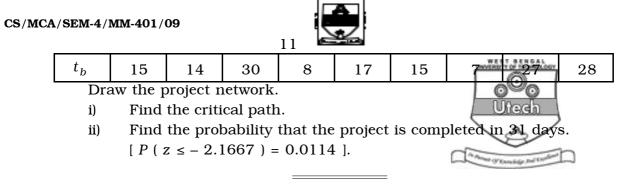
ii) Indicate the critical path and calculate the total float and free float for each activity. 7

15. a) The following network gives the distance in miles between pairs of entries 1, 2, and 8. Find the shortest rout-between city 1 and 8 using Dijkstras Algorithm.

Dia.

b) The following table shows the jobs of a network along with their time estimates. The time estimates are in days :

Job	1 - 2	1 - 6	2 - 9	2 - 4	3 - 5	4 - 5	5 - 8	6 - 7	7 - 8
to	3	2	6	2	5	3	1	3	4
t _m	6	5	12	5	11	6	4	9	9



END