## OPERATION RESEARCH ( SEMESTER-8)

## CS/B.TECH (CHE-NEW)/SEM-8/CHE-804B/09

1. $\qquad$
Signature of Invigilator

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Signature of the Officer-in-Charge
Reg. No.


## CS/B.TECH (CHE-NEW)/SEM-8/CHE-804B/09 ENGINEERING \& MANAGEMENT EXAMINATIONS, APRIL - 2009 OPERATION RESEARCH (SEMESTER - 8 )

## INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of $\mathbf{3 6}$ 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 marked 'Answer Sheet'.
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



## ENGINEERING \& MANAGEMENT EXAMINATIONS, APRIL - 2009 OPERATION RESEARCH <br> SEMESTER - 8 <br> tFull Marks: 70 <br> 

Time : 3 Hours ]

Graph sheets are provided on Pages $33 \& 35$.

## GROUP - A <br> ( Multiple Choice Type Guestions )

1. Choose the correct alternatives for any ten of the following :
i) Bar chart is helpful in
a) efficient utilization of manpower and machines
b) preparing production schedule
c) efficient dispatching of products
d) inventory control.
ii) If we convert the inequation $x_{1}+x_{2} \leq 7$ into the equation $x_{1}+x_{2}+x_{3}=7$, then $x_{3}$ is a/an
a) slack variable
b) surplus variable
c) artificial variable
d) both artificial and surplus variable.
iii) The coefficient of artificial variables in the constraint is
a) +1
b) -1
c) $\quad \mathrm{M}$
d) 0 .
iv) Hungarian algorithm is used for
a) transportation problem
b) assignment problem
c) queueing theory
d) simplex method.
v) In a transportation problem with $m$ origin and $n$ destinations (balanced) the number of independent constraints are
a) $m+n$
b) $m n$
c) $m+n-1$
d) $m+n+11$
vi) The earliest expected time ( $T_{E}^{j}$ ) for the successor event is calculated by
a) $\quad T_{E}^{j}=$ maximum of $\left(T_{L}^{j}-t_{E}^{i j}\right)$
b) $\quad T_{E}^{j}=$ maximum of $\left(T_{E}^{i}+t_{E}^{i j}\right)$
c) $\quad T_{E}^{j}=$ minimum of $\left(T_{E}^{i}+t_{E}^{i j}\right)$
d) $\quad T_{E}^{j}=$ maximum of $\left(T_{E}^{i}-t_{E}^{i j}\right)$.
vii) slack time $\left(\tau_{s}^{j}\right)$ is equal to
a) $\quad T_{L}^{j}-T_{E}^{j}$
b) $\quad T_{E}^{j}-T_{L}^{j}$
c) $\quad T_{E}^{j}+t_{E}^{i j}$
d) $\quad T_{L}^{j}-t_{E}^{i j}$.
viii) Traffic intensity of a simple queue is given by
a) $\rho=\frac{\mu}{\lambda}$
b) $\rho=\frac{\mu t}{\lambda}$
c) $\rho=\frac{\mu}{\lambda t}$
d) $\rho=\frac{\lambda}{\mu}$.
ix) The dual of a dual problem is
a) dual
b) primal
c) both of these
d) none of these.
x) MODI method is used for optimality test in
a) simplex method
b) assignment problem
c) queueing theory
d) transportation problem.
xi) The variable(s) in the inventory is/are
a) controlled variable
b) uncontrolled variable
c) both (a) and (b)
d) none of these.
xii) Monte-Carlo technique is used for
a) decision making
c) modeling
b)

d) none of these. A

## GROUP - B

## ( Short Answer Type Questions )

Answer any three of the following questions.
2. Three different types of trucks $A, B$ and $C$ have been used to transport 60 tons solid and 35 tons liquid substance. A type truck can carry 7 tons solid and 3 tons liquid. $B$ type truck can carry 6 tons solid and 2 tons liquid and $C$ type truck can carry 3 tons solid and 4 tons liquid. The cost of transport are Rs.500, Rs. 400 and Rs. 450 per truck of $A, B$ and $C$ respectively. Formulate the problem mathematically and find the minimum transport cost.
3. What is operations research ? What are the applications of OR model ?
4. make a graphical representation of the set of constraints in the following LPP. Find the extreme points of the feasible region. Find also the maximum value of the objective function.

Maximize $\quad Z=4 x_{1}+3 x_{2}$

Subject to $\quad x_{1}+x_{2} \leq 50$,

$$
x_{1}+2 x_{2} \leq 80
$$

$$
2 x_{1}+x_{2} \geq 20
$$

and

$$
x_{1} \geq 0, x_{2} \geq 0
$$

5. A salesman has to visit five cities $A, B, C, D$ and $E$. The, distance ( in hundred kilometers ) between the five cities are as follows :


| A | A | B | C | D |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | - | 8 | 12 |  | 10 |
| B | 8 | - | 7 | 11 | 14 |
| C | 12 | 7 | - | 19 | 20 |
| D | 14 | 11 | 19 | - | 15 |
| E | 10 | 14 | 20 | 15 | - |

If the salesman starts from city $A$ and has to come back at city $A$, which route should be selected so that the total distance travelled is a minimum.
6. Prove that $L_{q}=L_{s}-\frac{\lambda}{\mu}$ of an $\mathrm{M} / \mathrm{M} / 1$ queueing model.

## GROUP - C

## ( Long Answer Type Guestions )

Answer any three of the following questions.
7. a) Define variance and standard deviation.
b) Determine the optimal project cost and duration for the following data :

| Activity | Normal |  | Crash |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Time ( days ) | Cost (Rs.) | Time ( days ) | Cost (Rs.) |
| $1-2$ | 8 | 100 | 6 | 200 |
| $1-3$ | 4 | 150 | 2 | 350 |
| $2-4$ | 2 | 50 | 1 | 90 |
| $2-5$ | 10 | 100 | 5 | 400 |
| $3-4$ | 5 | 100 | 1 | 200 |
| $4-5$ | 3 | 80 | 100 |  |

Indirect cost is Rs.70/day.
c) Draw a CPM network, considering the following information of a project. Number the events in the network according to the Fulkerson's rulg the steps of 10 .
i) $\quad A$ is the first and $K$ is the final operation of the project
ii) $\quad F$ and $G$ can be done concurrently, but both mast follow $A$
iii) $\quad F$ must precede $H$
iv) $J$ cannot begin until both $F$ and $G$ are completed
v) $\quad K$ is dependent on the completion of both $H$ and $J$.
8. a) Formulate the dual of the primal LPP

Minimize $\quad Z=10 x_{1}+2 x_{2}$
Subject to $\quad x_{1}+2 x_{2}+2 x_{3} \geq 1$,

$$
x_{1}-2 x_{3} \geq-1
$$

$$
x_{1}-x_{2}+3 x_{3} \geq 3
$$

and $\quad x_{1} \geq 0, x_{2} \geq 0, x_{3} \geq 0$.
b) Solve the L.P.P by simplex method.

Maximize $\quad Z=2 x_{1}-x_{2}+5 x_{3}$
Subject to $\quad x_{1}+2 x_{2}+2 x_{3} \leq 2$,

$$
\begin{align*}
& \frac{5}{2} x_{1}+3 x_{2}+4 x_{3}=12 \\
& 4 x_{1}+3 x_{2}+2 x_{3} \geq 24
\end{align*}
$$

and $\quad x_{1} \geq 0, x_{2} \geq 0, x_{3} \geq 0$.
9. a) Find out the optimal transportation schedule using Vogal's appromixation method.

|  | $D_{1}$ | $D_{2}$ | $D_{3}$ | $D_{4}$ | $a_{j}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 01 | 10 | 7 | 3 | 6 | 3 |
| 02 | 1 | 6 | 8 | 3 | 5 |
| 03 | 7 | 4 | 5 | 3 | 7 |
| $b_{j}$ | 3 | 2 | 6 | 4 |  |

b) In a factory there are four operators and four machines. The assignment cost in rupees are given below. Operator 1 cannot be assigne \& to machine III and operator 3 cannot be assigned to machine IV. Findeque optimal cost of assignment.

|  | Machine I <br> Machine II <br> Machine III |  |  | Machine IV |
| :---: | :---: | :---: | :---: | :---: |
| Operator 1 | 5 | 5 | - | 2 |
| Operator 2 | 7 | 4 | 2 | 3 |
| Operator 9 | 9 | 3 | 5 | - |
| Operator 4 | 7 | 2 | 6 | 7 |

10. a) The annual demand of an item is 3200 units. The unit cost is Rs. 6 and inventory carrying charges $25 \%$ per annum. If the cost of one procurement is Rs. 150, Determine :
i) EOQ
ii) Number of order per year
iii) The optimal cost.
b) An automobile company manufactures around 150 scooters. The daily production varies from 146 to 154 depending upon the availability of raw materials and other working conditions :

| Production (per day ) | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Probability | 0.04 | 0.09 | 0.12 | 0.14 | 0.11 | 0.10 | 0.20 | 0.12 | 0.08 |

The finished scooters are transported in a specially arranged truck accommodating 150 scooters.

Using the following random numbers
$80,81,76,75,64,43,18,26,10,12,65,68,69,61,57$,
simulate the process to find out,
i) what will be the average number of scooters waiting in the factory
ii) what will be the average number of empty space on the truck.
11. Write short notes on any three of the following :
a) Different types of inventories
b) Crashing of network

c) Critical path method
d) Basic characteristics of a queueing system
e) Vogal's approximation method
f) The Optimistic, Pessimistic \& Most likely time estimate.

END

