



Name :
Roll No. :
Invigilator's Signature :

CS/B.TECH(ME/PE)/SEM-7/ME-703/2011-12

2011

OPERATIONS RESEARCH & INDUSTRIAL MANAGEMENT

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$
 - i) Linear programming is a
 - a) constrained optimization technique
 - b) technique for economic allocation of limited resources
 - c) mathematical technique
 - d) all of these.
 - ii) A feasible solution to an LP problem
 - a) must satisfy all of the problems constraints simultaneously
 - b) need not satisfy all of the constraints, only some of them
 - c) must be corner point of the feasible region
 - d) must optimize the value of the objective function.



- iii) The graphical method of LP problems uses
- a) objective function equation
 - b) constraint equation
 - c) linear equations
 - d) all of these.
- iv) For a maximization problem, the objective function co-efficient for an artificial variable is
- a) $+M$
 - b) $-M$
 - c) zero
 - d) none of these.
- v) If dual has unbounded solution, primal has
- a) no feasible solution
 - b) unbounded solution
 - c) feasible solution
 - d) none of these.
- vi) CPM has
- a) one-time estimate
 - b) two-time estimate
 - c) three-time estimate
 - d) four-time estimate.
- vii) The initial solution of a transportation problem can be obtained by applying any known method. However, the only condition is that
- a) the solution be optimal
 - b) the rim condition are satisfied
 - c) the solution not be degenerate
 - d) all of these.



- viii) An assignment problem is considered as a particular case of a transportation problem because
- a) the number of rows equals columns
 - b) all $x_{ij} = 0$ or 1
 - c) all rim conditions are 1
 - d) all of these.
- ix) One disadvantage of using North-West Corner Rule to find initial solution to the transportation problem is that
- a) it is complicated to use
 - b) it does not take into account cost of transportation
 - c) it leads to a degenerate initial solution
 - d) all of these.
- x) A type of decision making environment is
- a) certainty
 - b) uncertainty
 - c) risk
 - d) all of these.

GROUP – B

(Short Answer Type Questions)

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

2. With the help of quantity-cost curve, explain the significance of Economic order quantity (EOQ).
3. Explain how an assignment problem can be solved as a transportation problem.
4. Write short notes on different selective inventory control techniques.
5. Discuss about crashing of projects related with project management.
6. Show that average number of units in (M/M/1) queuing model is equal to $\rho/(1-\rho)$, where ρ is the traffic intensity.



GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Use penalty (Big M) method to solve the following L.P. problem : 10

Maximize : $Z = 5x_1 + 3x_2$ subject to constraints

$$2x_1 + 4x_2 \leq 12$$

$$2x_1 + 2x_2 = 10$$

$$5x_1 + 2x_2 \geq 10, x_1, x_2 \geq 0.$$

- b) Write down the dual of the following L.P. problem : 5

Maximize : $Z = 3x_1 - 2x_2 + 4x_3$ subject to constraints

$$3x_1 + 5x_2 + 4x_3 \geq 7$$

$$6x_1 + x_2 + 3x_3 \geq 4$$

$$7x_1 - 2x_2 - x_3 \leq 10, x_1 - 2x_2 + 5x_3 \geq 3$$

$$\text{and } 4x_1 + 7x_2 - 2x_3 \geq 2$$

$$\& x_1, x_2 \geq 0.$$

8. a) A steel company has three open hearth furnaces and five rolling mills. Transportation cost (Rs. per quintal) for shipping steel from furnaces to rolling mills are shown in the following table :

	M_1	M_2	M_3	M_4	M_5	Capacity (in quintal)
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	3	14
Requirement	4	4	6	8	8	

What is the optimal shipping schedule ? 8



- b) Five men are available to do five different jobs. From past records the time (in hrs.) that each man takes to do each job is known and is given in the following table. Assign each man to a job to get minimum time. 7

MEN	JOB				
	1	2	3	4	5
1	2	9	2	7	1
2	6	8	7	6	1
3	4	6	5	3	1
4	4	2	7	3	1
5	5	3	9	5	1

9. A small project is composed of 7 activities are listed in the table below. Activities are identified by their beginning (i) and end (j) node numbers.

Activity	Estimated time (weeks)	Most likely (weeks)	Pessimistic time (weeks)
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15

- Draw the network diagram of the activities in the project.
- Find the expected duration and variance of each activity.
- What is the expected project length ?
- What is the probability that the project will be completed at least 4 weeks earlier than expected time ?



e) If the project due date is 19 weeks, what is the probability of not meeting the due date ?

Given Z	0.50	0.67	1.00	1.33	2.00
Probability	0.3085	0.2514	0.1587	0.0918	0.0028

15

10. a) A market survey is made on three brands of breakfast foods X, Y and Z. Every time the consumer purchases a new package, he may buy the same brand or switch to another brand. The following estimates are obtained expressed as decimal fractions :

Present Brand	Brand just purchased		
	X	Y	Z
X	0.7	0.2	0.1
Y	0.3	0.5	0.2
Z	0.3	0.3	0.4

At this time it is estimated that 30 per cent of the people buy brand X, 20 per cent buy Y and 50 per cent brand Z. What will be the distribution of customers be, two time periods later, and at equilibrium ?

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b) The production department of a company requires 3600 kg of raw materials for manufacturing a particular item per year. It has been estimated that the cost of placing order is Rs. 36 and the cost of carrying inventory is 25 per cent of the investment in inventories. The price is Rs. 10 per kg. Determine the optimal lot size, optimal order cycle time and the minimum yearly total inventory cost.

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11. a) Write short notes on any *two* of the following : 2×4
- i) Training scheme
 - ii) Budget and Budgetary control
 - iii) Industrial disputes
 - iv) Industrial safety.

- b) Two workmen *A* and *B* while working on two identical machines produced respectively 750 and 850 numbers of the same job whose standard production is 100 nos. per hour.

The following are the particulars of the wage incentive plan :

Standard output per hour : 100 nos.

Rate differentials to be applied : 80 per cent of the std. piece rate for below std. performance and 120 per cent of the standard piece rate for standard and above standard performance. Calculate the earnings of each operator.

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