INDIAN INSTITUTE OF MATERIALS MANAGEMENT

JUN-2010 **Post Graduate Diploma in Materials Management**

Graduate Diploma in Materials Management

PAPER - 2

QUANTITATIVE METHODS

Date: 13.06.2010 **Max. Marks: 100**

Time: 2.00pm to 5.00pm **Duration: 3 hours**

Instructions:

1]. The question paper is in two parts- Part A: Objective Type (Compulsory) and Part B: Theory problems.

2]. From part A, answer all questions. Each question carries 1 mark, total 25 marks.

3]. From part B, answer any 5 questions out of 8 questions. Each question carries 15 marks, total 75 marks.

4]. Use of calculator and/or mathematical table is permitted.

5]. Graph sheet can be used wherever necessary.

PART A

Q1. (A) State whether the following statements are true or false: (15 Marks)

a). Allocation of optimum man-power to a particular job in order to minimize cost is a linear programming problem.

b). A two variable LPP problem can be solved by Simplex method.

c). If the constraints are inconsistent there is no feasible solution to a linear programming problem.

d). Occupied cells in the transportation problem have no allocation.

e). In an unbalanced transportation problem of minimization type zero cost is allocated to dummy cells.

f). Loping and cycling are not faults in the network.

g). An assignment problem cannot be solved by enumeration method.

h). In a zero-sum game has actions that maximize expected gains and minimize expected loss.

i). Total project duration on a network follows beta distribution.

j). Kendall's notation can be used to represent a waiting line

k). A pre-emptive priority is a static queue discipline.

l). A buffer stock represents safety units of inventory against stock outs.

m). Dynamic programming generates non-integer solutions to an LPP.

n). Inter arrival time in a queue systems follows Poisson distribution.

o). A normal distribution applies to a variable taking discrete values.

Q1. (B) Define the following: (10 Marks)

a). Iso-profit line
b). Unbounded solution
c) Gomory cut
d). Critical event
e). Crashing

PART B

Q.2. (A). Cycle Trends is introducing two new lightweight bicycle frames, the Deluxe and the Professional, to be made from aluminum and steel alloys. The anticipated unit profits are Rs. 10 for the Deluxe and Rs. 15 for the Professional. The number of units of each alloy needed per frame is summarized in the table. A supplier delivers 100 units of the aluminum alloy and 80 units of the steel alloy weekly. Formulate this as a linear programming problem. **(5 Marks)**

Unit of each alloy needed per frame

	Aluminum Alloy	Steel Alloy
Deluxe	2	3
Professional	4	2

Q.2. (B). Solve the following LPP by graphical method

Maximize Z = 10X1 + 8X2

Subject to constraints

$2X1 + X2 \leq 20$

$X1 + 3X2 \leq 30$

$X1 - 2X2 \geq -15$

$X1\ X2 \geq 0$ **(10 Marks)**

Q.3. A company has four manufacturing plants and five warehouses. Each plant manufactures the same product which is sold at different process in each warehouse area. The cost of manufacturing and the cost of raw material are different in each plant due to various factors.

The data is given in the table below:

Item	Plant			
	1	2	3	4
Manufacturing Cost / unit Rs.	12	10	8	8
Raw Material Cost / unit Rs.	8	7	7	5
Capacity per unit time	100	200	120	80

The company has five warehouses. The sale prices, transportation costs and demands are given in the following table:

Warehouse	Transportation Cost (Rs.) per Unit				Sale Price	Demand per Unit (Rs.)
	1	2	3	4		
A	4	7	4	3	30	80
B	8	9	7	8	32	120
C	2	7	6	10	28	150
D	10	7	5	8	34	70
E	2	5	8	9	30	90

a) Compute the initial basic feasible solution using Vogel's Approximation Method. **(5 Marks)**

b) Test the solution for optimality and find the optimal basic feasible solution and total transportation cost. **(10 Marks)**

Q.4. An electronic company manufactures small electrical devices. Products are manufactured on five different assembly lines (1,2,3,4,5). When manufacturing is finished, products are transported from the assembly lines to one of the five different inspection areas (A,B,C,D,E). Transporting products from five assembly lines to five inspection areas requires different times (in minutes) as shown in the table below: **(15 Marks)**

Assembly Line	Inspection Area				
	A	B	C	D	E
1	10	4	6	10	12
2	11	7	7	9	14
3	13	8	12	14	15
4	14	16	13	17	17
5	19	11	17	20	19

Find the optimal assignment using Hungarian Method to optimize time.

Q.**5**. From the table of activities associated with the project given below:

i) Draw the network

ii) Find the critical path

iii) Find the critical project duration.

Activities	A	B	C	D	E	F	G	H	I
Optimistic time	5	18	26	16	15	6	7	7	3
Pessimistic time	10	22	40	20	25	12	12	9	5
Most likely time	8	20	33	18	20	9	10	8	4

A, B, C are starting actitivies. B triggers F, A triggers E and D, F, E trigger I, D triggers H and C triggers G. H, I J are end activities. **(15 Marks)**

Q.6.(A). Explain with an example sequencing. **(5 Marks)**

Q.6.(B). A book binder has one prnting press, one binding machine and manuscripts of 7 different books. The times required for printing and binding operations are given in the following table:

Book	1	2	3	4	5	6	7
Printing Time	20	90	80	20	120	15	65
Binding Time	25	60	75	30	90	35	50

Determine the sequence will minimize the total time.

(10 Marks)

Q.7. **(5+10 Marks)**

On average 6 customers are served by a telephone booth every hour. What is the probability that a customer will have to wait at the booth and what is the average length of the queue? The length of telephone is exponential with a mean of 3 minutes.

Q.8. **(15 Marks)**

Solve the LPP using Simplex Method:

Maximize Z = 4X1 + 3X2

Subject to the constraints:

2X1 + X2 <= 1000
X1 <= 400
X2 <= 700

X1, X2 >= 0

Q.9. **(15 Marks)**

Solve the game graphically:

Player B

		B1	B2
Player A	A1	1	2
	A2	4	5
	A3	9	-7
	A4	-3	-4
	A5	2	1