STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2004 – 05 & thereafter)

SUBJECT CODE: MT/PE/OP14

M. Sc. DEGREE EXAMINATION, NOVEMBER 2007
BRANCH I - MATHEMATICS
FIRST SEMESTER

COURSE : ELECTIVES
PAPER : OPTIMIZATION TECHNIQUES
TIME : 3 HOURS **MAX. MARKS : 100**

SECTION – A **(5 X 8 = 40)**

ANSWER ANY FIVE QUESTIONS

1. A food item F_1 contains 20 units of vitamins and 40 units of minerals per gram. Food item F_2 contains 30 units of vitamins and 30 units of minerals per gram. The daily requirements of vitamins and minerals are 900 units and 1200 units respectively. The cost of food F_1 is 60 paise per gram and food F_2 is 80 paise per gram. How many grams of F_1 and F_2 should be consumed so as to minimize the cost? Formulate this as LPP and solve it by graphical method.

2. Using simplex method, solve the following Linear Programming problem.
   Maximize: $Z = x_1 + x_2 + 3x_3$
   Subject to the constraints
   $2x_1 + x_2 + 2x_3 \le 2$
   $3x_1 + 2x_2 + x_3 \le 3$
   $x_1, x_2, x_3 \ge 0$.

3. The transportation cost per unit from sources to destinations is given in the following table.

		Destination				
		D_1	D_2	D_3	D_4	Availability
Source	S_1	5	4	2	8	8
	S_2	4	7	5	6	10
	S_3	3	6	8	7	12
Demand		6	8	12	4	

   Obtain the initial basic solution using Least Cost method.

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4. There are five mechanics and five machines in a small factory. Only one machine can be assigned to a mechanic. The time taken by the mechanics on the machines are given below. Solve it.

		Machine				
		P	Q	R	S	T
Mechanics	A	20	15	25	25	29
	B	13	19	30	13	19
	C	20	17	14	12	15
	D	14	20	20	16	24
	E	14	16	19	11	22

5. Solve the following Integer Programming Problem.

Minimize $Z = -2x_1 - 3x_2$

Subject to $2x_1 + 2x_2 \leq 7$

$x_1 \leq 2$

$x_2 \leq 2$

$x_1, x_2 \geq 0$ and integers.

6. The following table gives the activities in a construction project.

Activity	1-2	1-3	2-3	2-4	3-4	4-5
Duration (Days)	20	25	10	12	6	10

(i) Draw the network diagram.

(ii) Find the critical path and project duration.

(iii) Obtain the total float for each activity.

7. Commuters arrive at a ticket counter in Poisson fashon with an average of 20 commuters per hour. The service time is distributed exponentially with mean of 1 minute. Find

(i) Average number of commuters in the system.

(ii) Average queue length.

(iii) Average waiting time of a commuter in the queue.

SECTION – B **(3 X 20 = 60)**

ANSWER ANY THREE QUESTIONS

8. Using the two phase method, solve the following LPP.

Min $Z = 4x_1 + 3x_2 + 9x_3$

Subject to $2x_1 + 4x_2 + 6x_3 \geq 15$

$6x_1 + x_2 + 6x_3 \geq 12$

$x_1, x_2, x_3 \geq 0$.

9. A company has 3 factories A, B and C which supply items to the 4 warehouses D, E, F and G. Monthly factory capacities are 160, 150 and 190 units from A, B and C respectively. The warehouse requirements for D, E, F and G are 80, 90, 110 and 160 units respectively. The shipping costs per unit in Rupees are shown below.

		Warehouse			
		D	E	F	G
Factory	A	42	48	38	37
	B	40	49	52	51
	C	39	38	40	43

Using Vogel's method find the initial basic solution and hence the optimum solution.

10. The following table shows the traveling cost from one place to the next. Solve it as a traveling salesman problem so as to minimize the cost per cycle.

		To				
		P	Q	R	S	T
From	P	-	2	5	1	2
	Q	2	-	4	1	2
	R	5	4	-	5	3
	S	1	1	5	-	5
	T	2	2	3	5	-

11. Consider the details of the activities of a project, where the duration are given in days.

Activity	1-2	1-3	1-4	2-4	2-5	3-4	4-5
Optimistic Time	4	8	6	2	3	2	3
Most likely Time	5	9	8	4	4	3	5
Pessimistic Time	6	11	12	6	6	4	8

(i) Draw the network diagram.

(ii) Find the critical path.

(iii) Find the mean and variance of the project completion time.

12. a) Discuss the input, service, queue discipline and customer behaviour associated with a queuing system.

b) State and establish the Arrival distribution Theorem.