Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(IEM)/SEM-1/IEM-101/2012-13

2012

QUANTITATIVE METHODS & SIMULATION TECHNOLOGY

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.

Graph sheet will be supplied by the institution.

Answer any *five* questions. 5 × 14 = 70

1. a) A project is represented through the data presented in the following table :

Activity	I_o	I_m	I_p
1 – 2	5	8	10
1 – 3	18	20	22
1 – 4	26	33	40
2 – 5	16	18	20
2 – 6	15	20	25
3 – 6	6	9	12
4 – 7	7	10	12
5 – 7	7	8	9
6 – 7	3	4	5

i) Draw the logic network of the above activities.

ii) Determine the duration of the project using forward pass method.

iii) Determine critical path using backward pass method.

iv) The probability of an event occurring at the prepared completion date if the original contract time of completing the project is 41·5 weeks.

v) The duration of the project that will have 95% chance of being completed.

Given : z :	– 0·52	0	1	1·64
Probability :	0·30	0·50	0·84	0·95

3 + 2 + 2 + 2 + 2

b) Elucidate on 'Time-cost-trade off' in project. 3

2. a) i) Draw the flow diagram with delay in acquisition rate of an inventory system using system dyamics symbols, comprising ordering rate, sales rate with STEP function, fraction ordered per week, desired inventory level and discripancy.

ii) Write the Dynamo equations for the above. 3 + 4

b) Work out the simulation for both 'level' and 'rate' over a 10-period time horizon and interprete the result by plotting the results graphically under the condition of positive feedback of system dynamics. Consider the value of initial level of 20 and the constant of proportionality as 0·19. 7

3. Define continuous and combinatorial optimization problems with examples. Define constructive and improvement heuristics. Define hard, soft, explicit and implicit constraints. 6 + 4 + 4

4. What is a linear programming problem ? Define basic, non-basic, degenerate and non-degenerate solutions. Solve the following problem using the simplex method :

$$\text{Minimize} \quad x_1 - 2x_2 + x_3$$

$$\text{subject to} \quad x_1 + 2x_2 - 2x_3 \leq 4$$

$$x_1 - x_3 \leq 3$$

$$2x_1 - x_2 + 2x_3 \leq 2$$

$$x_1, x_2, x_3 \geq 0$$

2 + 4 + 8

5. Write down the general form of a goal programming model and explain each of its components. What are the differences between a goal programming problem and a multi-objective programming problem ? Define absolute and non-absolute goals. Which deviation variables will you minimize and why in the case of 'greater than equal to', 'less than equal to' and 'equality' type goals in goal programming ?

4 + 3 + 4 + 3

6. Describe discrete and continuous systems with simple examples. State the usefulness of simulation techniques. Explain the discrete-event simulation process with a flow chart. 5 + 2 + 7

7. Define feasible, near optimal and global optimal solutions. Solve the following problem using Fletcher-Reeves method :

Minimize : $2x_1^2 - 4x_1 - 4x_1x_2 + 4x_1^2 + 4$. 6 + 8

8. Write short notes on any *two* of the following : 7 + 7

a) Meta-heuristics

b) Single objective *vs* multi-objective optimization

c) Foundations of System Dynamics

d) System Dynamics Micro World.