

**B.Tech. Civil (Construction Management) /  
B.Tech. Civil (Water Resources Engineering)**

**Term-End Examination  
June, 2013**

**00457**

**ET-301(A)/ET-534(B) : SYSTEMS METHODS**

*Time : 3 hours*

*Maximum Marks : 70*

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*Note : All questions are compulsory. Use of scientific calculator is permitted.*

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1. Answer *any six* questions from the following :  $6 \times 5 = 30$

- (a) What do you understand by "System" ? Describe how the thermostat of a refrigerator and a room air-conditioner works. Also draw the block diagram.
- (b) Describe the significance of mathematical models for any mechanical system.
- (c) What is the importance of physical models ? Describe any two types of physical models.
- (d) Derive the electric analogue of a spring mass damper system.

- (e) Describe the automatic temperature control system incorporated in the electric iron, and also draw a functional block diagram for it.
- (f) Draw a speed control system for a DC motor.
- (g) Discuss the stability of control systems. Describe the various conditions for stability.
- (h) Describe, why the DC motor is the most suitable motor for variable speed drives ?

2. Answer *any two* of the following : 2x10=20

- (a) Solve the following linear programming problem by graphically :

$$\text{Maximize } z = 3x_1 + 5x_2$$

$$\text{subject to } x_1 + 2x_2 \leq 20$$

$$x_1 + x_2 \leq 15$$

$$x_2 \leq 6$$

$$\text{and } x_1 \geq 0 ; x_2 \geq 0.$$

- (b) A company has three plants with respective plant capacities of 7, 12, and 8. The plants are required to meet the demand at four markets with respect demands of 5, 12, 6, and 4. The cost of shipping unit product  $C_{ij}$  from the plant  $i$  to market  $j$  is given in the following table.

Design a shipment schedule to minimise the total cost of transportation.

Transportation matrix

Plant	Market				Capacity
	1	2	3	4	
1	5	8	10	6	7
2	12	4	8	7	12
3	6	10	5	13	8
Demand	5	12	6	4	27

- (c) An organisation is having five salesmen and five sales divisions. There was a study to assess the capability of the salesmen and the nature of each district. It is estimated that the sales per month (in lakhs of Rs.) for each salesmen in different divisions are as follows :

Salesman

		1	2	3	4	5
Division	A	32	40	41	22	29
	B	38	24	27	38	33
	C	40	28	33	41	40
	D	28	21	30	36	36
	E	40	36	37	35	39

Use assignment method to allocate different divisions to each salesman to maximise sales.

3. Answer *any two* of the following : 2x10=20

(a) The R and D Department is planning to bid on a large project for the development of a new communication system for commercial planes. The accompanying table shows the activities, times, and sequences required.

Activity	Immediate Predecessor	Time (weeks)
A	-	3
B	A	2
C	A	4
D	A	4
E	B	6
F	C, D	6
G	D, F	2
H	D	3
I	E, G, H	3

- (i) Draw the network diagram.
- (ii) What is the critical path ?
- (iii) Suppose you want to shorten the completion time as much as possible, and have the option of shortening any or all of B,C,D and G each two weeks. Which would you shorten ?

(b) A local distributor for a national tyre

company expects to sell approximately 9600 steel - belted radial tyre of a certain size and thread design next year. Annual carrying costs are Rs. 16 per tyre, and ordering costs are Rs 75. The distributor operates 288 days a year.

- (i) What is the EOQ ?
  - (ii) How many times per year does the store reorder ?
  - (iii) What is the length of an order cycle ?
- (c) Repair calls are handled by one repairman at a photocopy shop. Repair time, including travel time, is exponentially distributed with a mean of two hours per call. Requests for copier repair come in at a mean rate of three per eight-hour day (assume Poisson distribution)

Determine the following :

- (i) The average number of customers awaiting repairs.
- (ii) System utilization
- (iii) The amount of time during an eight - hour day that the repairman is not out on a call.
- (iv) The probability of two or more customers in the system.