

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

**Term-End Examination**

**June, 2016**

00618

**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 non-programmable calculator is allowed. Each and every notation should be elaborated.*

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1. Answer any **six** of the following : 6×5=30

- (a) Define 'system' with specific reference to 'engineering system'.
- (b) Describe an engineering system with the help of a suitable example.
- (c) Consider a civil engineering 'structure', such as a building. If you think of it as a system, what will be its components ? And, in turn, if these components also happen to be systems, what are their components ? Where does the whole activity of literally building a house start ?

- (d) What will be the inputs and outputs for civil engineering systems such as a building, a bridge and a road ? Elaborate.
- (e) An electric lamp has power of 12 watt, when a potential difference of 100 volt is applied. What is its resistance ? Explain with a mathematical model.
- (f) Give two examples of a variety of physical systems such as electrical, mechanical, thermal, chemical and biological systems.
- (g) Consider the domestic temperature controlled electric iron. It is an example of a temperature control system. Draw a block diagram for it and identify the reference input, error and output signals, controller and plant.
- (h) Explain, with the help of a diagram, how the thermostat of a refrigerator works.
- (i) How does a closed-loop (feedback) control system work ? Illustrate giving an example.
- (j) Give two examples of a manual-auto control system.

2. Answer any *two* of the following : 2×10=20

(a) Maximize  $z = 4x_1 + 5x_2$   
 subject to  $3x_1 + 2x_2 \leq 6$   
 $2x_1 + 4x_2 \leq 5$   
 $x_1, x_2 \geq 0$

Use linear programming simplex method for solving the problem.

- (b) Find the initial basic feasible solution for the following transportation problem by Vogel's Approximation method. Also obtain the solution by Least Cost method and compare both the solutions.

		Destination				Supply
		D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	
Origin	O <sub>1</sub>	11	13	17	14	250
	O <sub>2</sub>	16	18	14	10	300
	O <sub>3</sub>	21	24	13	10	400
Demand		200	225	275	250	

- (c) A booking counter takes 10 minutes to book a ticket for each customer. If the customers are arriving according to a Poisson process with a rate of 5 per hour, then find out :
- Expected queue length
  - Expected waiting time of a customer in the queue
  - Expected time a customer spends in the system

3. Answer any *two* of the following :

2×10=20

(a) A car manufacturing company has decided to redesign its fuel pump for their new car model. This project involves several activities which are listed in the table below. First activity is that the engineering department must develop/evolve the design of fuel pump. Second, the marketing department must develop the marketing strategy for its promotion. Third, a new manufacturing process must be designed. Fourth, advertising media must be selected. Finally, the pump must be released in the market.

Activity	Description of Activity	Predecessor Activity	Time Estimate (weeks)
A	Evolve the pump design	-	5
B	Develop marketing strategy	A	4
C	Design manufacturing process	A	7
D	Sales advertising media	B	8
E	Initial production run	C	9
F	Release fuel pump to the market	D, E	4

Draw a network diagram for the given project. Identify the critical path. Find out the total project time. Compute total float, free float and independent float for each activity.

(b) A company has two flour mills, X and Y, which have different production capacities for high, medium and low grade flour. This company has entered a contract to supply flour to a firm every month with at least 18, 12 and 24 quintals of high, medium and low grades, respectively. It costs the company ₹ 2,000 and ₹ 1,800 per day to run the mills X and Y, respectively. On a day, mill X produces 2, 4 and 8 quintals of high, medium and low grade flour, respectively. Mill Y produces 2, 2 and 8 quintals of high, medium and low grade flour, respectively. How many days per month should each mill be operated in order to meet the contract order most economically ?

(c) Write short notes on any *four* of the following :

- (i) Factors affecting Inventory
- (ii) Kendall's Notations
- (iii) Fulkerson Rule
- (iv) Duality in Linear Programming
- (v) Sensitivity Analysis