P-003-027501 Seat No. _____

M. Sc. (ECI) (Sem. V) (CBCS) Examination

May / June - 2018

Paper - 17 : Basic Concepts of Control Systems

Faculty Code : 003

Subject Code : 027501

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

1 Answer the following questions in brief : (any **seven**) **14**

(1) Define controlled variable and manipulated variable.

(2) Find inverse Laplace of the function given as :

$$F(s) = \frac{s^2 + 4s + 3}{s(s+1)}$$

(3) For a given function, $F(s) = \frac{1}{(s+1)}$ find its final value at $\lim_{t \to \infty} f(t)$.

(4) Find Laplace transform of the function given as : $x' - 4x = 0$

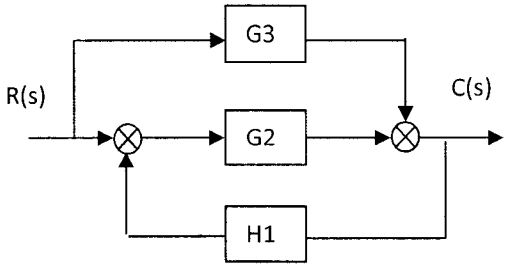
(5) Explain derivative control action with help of necessary equation and graph.

(6) Briefly explain the block diagram of a closed loop control system.

(7) Describe PI (Proportional-Integral) control mode in brief.

(8) Briefly explain partial fraction method of inverse Laplace transform with MATLAB.

(9) Reduce the block-diagram to minimum :



(10) Define a 2nd order system with help of appropriate examples.

2 Attempt any **two** of the following questions : **14**

(1) Derive the mathematical model of a thermal system.

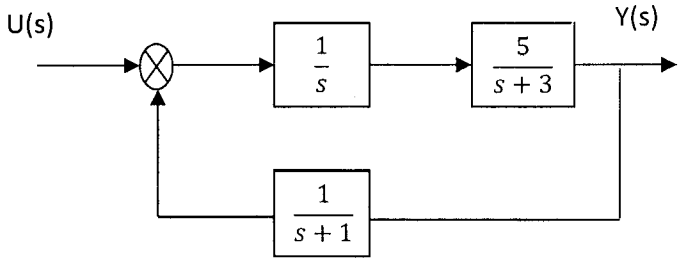
(2) Derive the mathematical model of an electrical system comprising of a series RLC circuit.

(3) Explain the unit-ramp response of first order system with necessary equations.

3 Answer the following questions :

(1) Explain how a non-linear mathematical model can be approximated to linear. **5**

(2) Derive state space representation for the system in the block diagram. **5**



(3) Explain impulse function in detail. **4**

4 Answer the following questions :

(1) Explain non-linear systems. **5**

(2) Explain various transient response specifications with necessary diagram. **5**

(3) Obtain the transfer function, for a system defined by following state-space equations : **4**

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -5 & -1 \\ 3 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 5 \end{bmatrix} u$$

$$y = \begin{bmatrix} 1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

OR

4 Answer the following questions :

(1) Derive the Laplace transform for ramp function. **5**

(2) State and prove the real differentiation and final value theorems. **5**

(3) Describe any two Laplace transform theorems with necessary derivation. **4**

5 Answer any **two** of the following questions : **14**

(1) Explain partial fraction method to find inverse Laplace transform. Also derive the inverse Laplace of $\frac{s^2 + 2s + 6}{(s+1)^3}$

(2) Mention and explain all rules to manipulate block-diagrams.

(3) Derive the transfer function for a liquid level system.

(4) Describe the state space representation of a dynamic system.
