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PA-003-113002

Seat No. _____

M. Sc. (Electronics) (Sem. III) (CBCS) Examination

May / June - 2018

Paper - 10 : Control System Analysis

Faculty Code : 003

Subject Code : 113002

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

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

(1) Find inverse Laplace transform of $F(S) = \dfrac{(s+3)}{s(s+1)(s+2)}$

(2) What is open-loop control system ?

(3) What is damping factor ?

(4) Find $x(t)$ for $x'' + 3x' + 2x = 0$ where $x(0) = a$ and $x'(0) = b$.

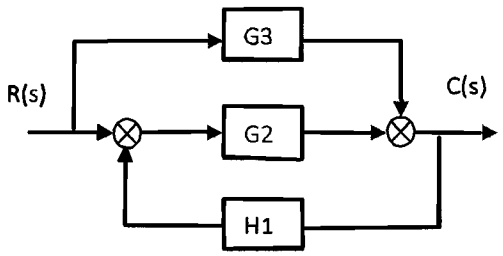
(5) Explain briefly conditionally stable system?

(6) Find Laplace transform of $\cos\left(4t + \dfrac{\pi}{4}\right)$

(7) Describe Proportional control mode in brief.

(8) Differentiate between controlled variable and manipulated variable.

(9) Reduce the block-diagram to minimum :



(10) Define a 1st order system with help of appropriate examples.

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

(each 7 marks)

(1) Enlist and explain rules for deriving Root locus for a positive feedback system.

(2) Describe Electric Furnace Control System in depth.

(3) Write a detailed note on Liquid-Level control system.

3 Answer the following questions :

(1) What is Routh's stability criterion? Explain with example. **7**

(2) For 2nd order system with step input, derive equations for rise time, peak time and maximum percentage overshoot. Consider the system to be underdamped. **7**

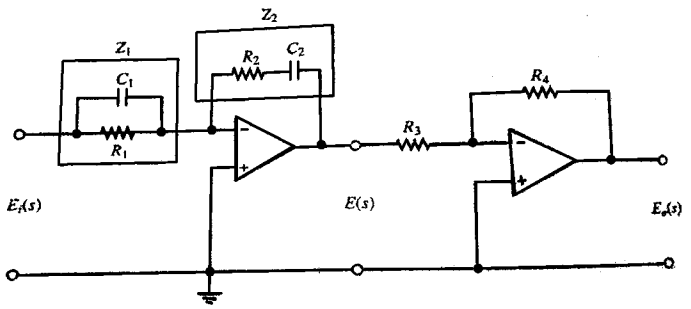
OR

3 Answer the following questions :

(1) For the following transfer function derive values of rise time, peak time, maximum percentage overshoot and settling time. Consider a unit step input is applied to the system with $\zeta = 0.6$ and $\omega_n = 5 rad / \sec$. **7**

$$\frac{C(S)}{R(S)} = \frac{{\omega_n}^2}{s^2 + \zeta\, \omega_n s + \omega_n 2}$$

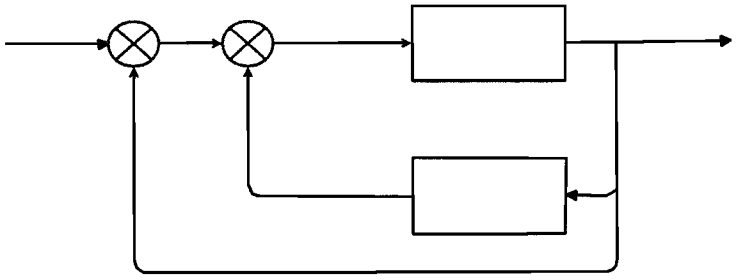
(2) For the PID controller circuit using op-amp derive the transfer equation and coefficients K_p, K_i and K_d. **7**



4 Answer the following questions :

(1) Write a detailed note on industrial controllers. **7**

(2) Plot root-locus curve for following system. Where, *Ka* varies from 0 to infinity so as K. **7**



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

(each 7 marks)

(1) Derive the mathematical model of a thermal system. The system comprises of a heater and a mixer in an insulated tank. In the tank a cold liquid is allowed and hot liquid is flown out of the tank.

(2) For the following polynomial equation determine the range of K such that the system remains stable.
$s^3 + 2s^2 + 6 = 0$

(3) Mention rules for block diagram reduction and explain each.

(4) Write a 'detailed note on effects of integral and derivative control action on system performance.