SEAT No. :

P2948

[5669]-537

T.E. (Electrical)

CONTROL SYSTEM - I

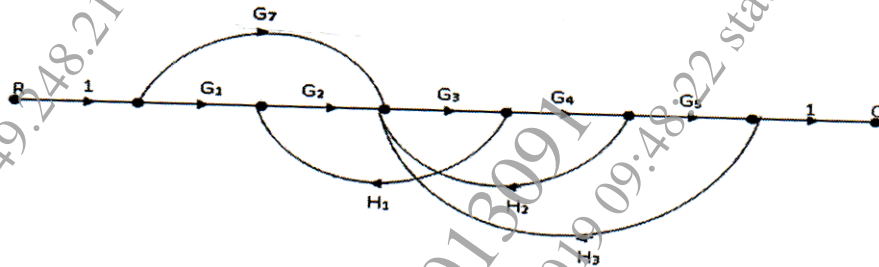**(2015 Pattern) (Semester - II)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) Answer all questions.

2) Use of non programmable calculator is allowed.

3) Figures to the right indicate full marks.

4) Assume suitable data, if necessary.

**Q1)** a) Find transfer function using Mason gain formula. **[7]**

b) For the unity feedback system with $G(s) = \dfrac{4900}{s(s+70)}$ find peak overshoot, settling time, for unit step input. What is steady state error for an input of $5tu(t)$. **[6]**

c) Construct Root Locus for unity feedback system with open loop transfer function given as $G(s) = \dfrac{K(s+1.5)}{s(s+1)(s+2)}$ **[7]**
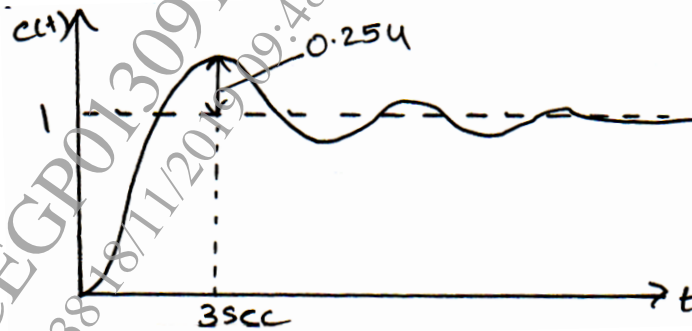
OR

Q2) a) Draw electrical analogues network for given mechanical system in F-V analogy and write differential equations. **[7]**
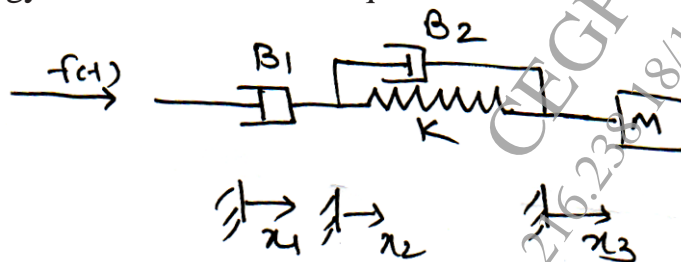
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b) For system with $G(s) = \dfrac{K}{s(Ts+1)}$, $H(s) = 1$ is subjected to a unit-step input, the system output responds as shown in Fig. Determine the values of K and T from the response curve. [6]

c) Find the positive value of K and a such that system with unity feedback and $G(s) = \dfrac{K(s+1)}{(s^3 + as^2 + 2s + 1)}$ oscillates at frequency of 2 rad/sec. [7]

Q3 a) Explain correlation between frequency domain and time domain. [6]

b) Sketch polar plot for system with open loop transfer function as [10]
$G(s) = \dfrac{50}{s(s+3)(s+6)}$ Obtain gain margin and phase margin.

OR

Q4) a) Explain Nyquist stability criterion. [6]

B) For Unity feedback system $G(s) = \dfrac{K}{(s+2)(s+4)(s+6)}$ plot Nyquist diagram. Find range of K for stability. [10]

Q5) a) Explain terms gain cross over frequency, phase cross over frequency, gain margin and phase margin. [6]

b) Sketch the bode plot for system with open loop transfer function as $G(s) = \dfrac{75(1+0.2s)}{s(s+3)}$. Determine from that wgc,wpc,GM,PM and comment on stability. [12]

<div align="center">OR</div>

Q6) a) State advantages of bode plot. **[6]**

b) Sketch bode plot for system with open loop transfer function as

$$G(s) = \frac{K}{s(1+0.02s)(1+0.04s)}$$ consider K = 1. Determine from that wgc, wpc, GM, PM. **[12]**

Q7) a) Explain P, PI, PID controller with their advantages and limitations. **[8]**

b) Obtain the tuning of PID controller for a unity feedback system with open loop transfer function as using Ziegler Nichols method

$$G(s) = \frac{12}{s(s^2 + 4s + 13)}$$ **[8]**

<div align="center">OR</div>

Q8) a) Explain Ziegler Nichols method of PID tuning when dynamic model of system is not available. **[8]**

b) Obtain the tuning of PID controller for a unity feedback system with open loop transfer function as given $G(s) = \dfrac{1}{(s+1)(s+3)(s+5)}$ using Ziegler Nichols method. **[8]**

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