Total No. of Questions : 8]

SEAT No. : ____

P1736

[Total No. of Pages : 3

[5460] - 566
T.E. (Electrical) (Semester - II)
CONTROL SYSTEM - I
(2015 Pattern)

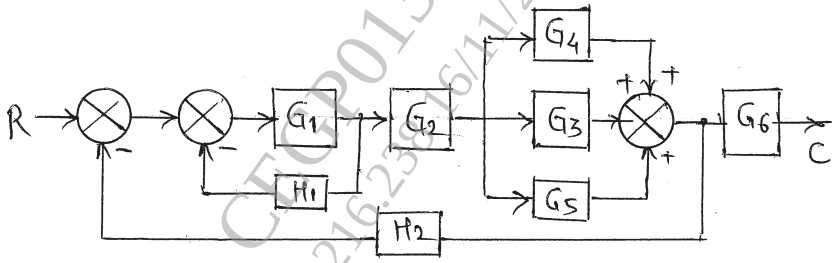
Time : 2½ Hours] ***[Max. Marks :70***

Instructions to the candidates:

1) ***Answer any one question from each pair of questions : Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***

Q1) a) Derive an expression for Force - voltage analogy in Translational and Rotational systems using simple R - L - C series circuit. **[8]**

b) Draw signal flow graph and obtain the transfer function using Mason's Gain Formula for the block diagram shown below : **[8]**



c) A unity feedback system having open loop transfer function. **[4]**

$$G(s) = \frac{100}{s(s+10)}$$

determine :

i) Error constants kp, kv and ka.

ii) Steady state error for unit step input.

OR

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Q2) a) Derive an expression for Rise time (Tr) and Settling time (Ts) for second order under damped system for unit step input. **[8]**

b) Sketch the root locus and comment on the stability for a unity feedback system with open loop transfer function. **[8]**

$$G(s)H(s) = \frac{K}{S(S+1+j)(S+1-j)}$$

c) For a system with $F(s) = s^4 + 22s^3 + 10s^2 + s + k$. Use Routh's criterion to obtain the marginal value of k and the frequency of oscillations of that value of k. **[4]**

Q3) a) Compare frequency domain specifications and time domain specifications of control system. **[8]**

b) The specifications of standard second order unity feedback control system are that the maximum overshoot must not exceed 30% and rise time must be less than 0.2 second. Find the limiting values of resonant peak Mr and Bandwidth. **[8]**

OR

Q4) a) Derive an expression for resonant frequency (ωr) for standard second order system. **[8]**

b) Sketch the Polar plot and determine gain margin for a unity feedback system having open loop transfer function. **[8]**

$$G(s) = \frac{1}{s(s+1)(2s+1)}$$

Q5) a) State and explain Nyquist stability criterion. **[6]**

b) The open loop transfer function of a unity feedback system is given by

$$G(s) = \frac{10}{s(1+0.5s)(1+0.1s)}$$

Draw Bode plot and determine GM, PM, gain cross over frequency and phase cross over frequency. Comment on stability of the system. **[12]**

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OR

Q6) a) Define the terms : Cut - off frequency (ωc), Resonance Peak Frequency (Mp), Resonant Frequency (ωr) **[6]**

b) Draw Bode plot for a system having **[12]**

$$G(s)H(s)=\frac{100}{s(s+1)(s+2)}$$

Comment on stability of the system.

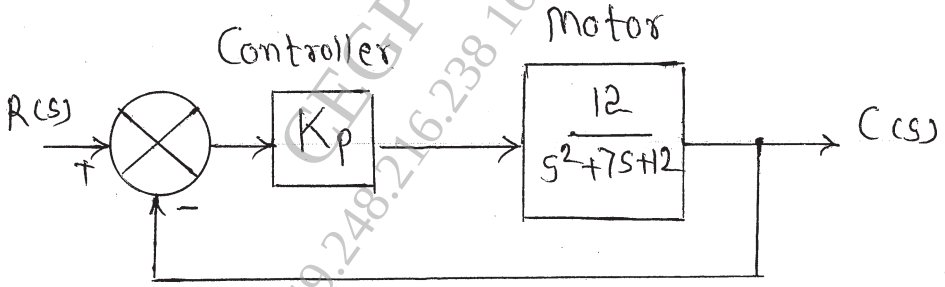
Q7) a) Draw block diagram and discuss PD controller. **[8]**

b) Write short note on Synchros. **[8]**

OR

Q8) a) Differentiate between phase Lead and phase Lag compensation. **[8]**

b) The system given below is so design to have damping ratio 0.707. Determine the required value of Kp for given damping ratio. **[8]**



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