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)

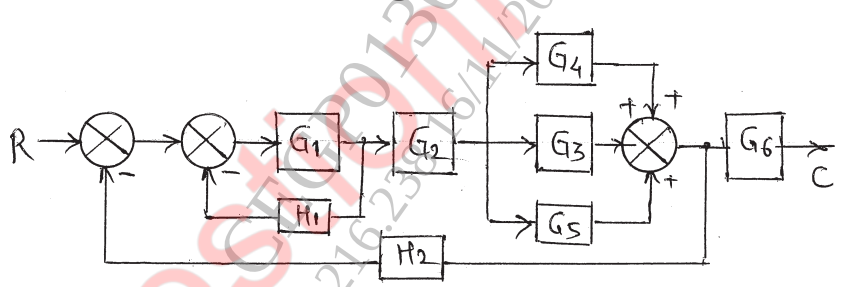
Time : 2½ Hours] *[Max. Marks :70*

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

P.T.O.

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]**

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.

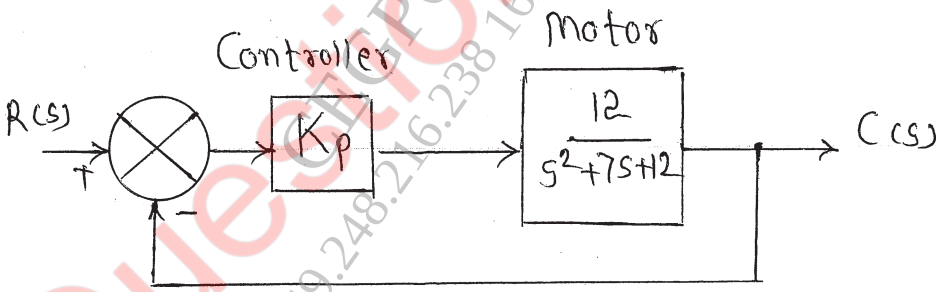
Q7) a) Draw block diagram and discuss PD controller. **[8]**

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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