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(Following Paper ID and Roll No. to be filled in your Answer Book)	
PAPER ID : 2112	Roll No.

B.Tech.

(SEM. V) ODD SEMESTER THEORY EXAMINATION 2013-14

CONTROL SYSTEM

Time : 3 Hours *Total Marks : 100*

Note :–Attempt **all** the questions.

1. Attempt any **four** parts of the following : **(5×4=20)**

(a) Find the transfer function of the electrical network shown in the figure : 1.

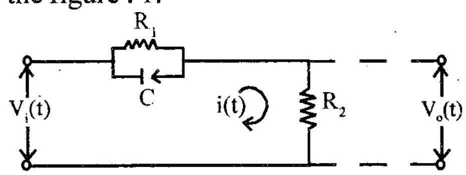

Figure : 1

(b) Compare the open loop control system and closed loop control system, also give few examples for each system.

(c) Find the single block equivalent of figure : 2.

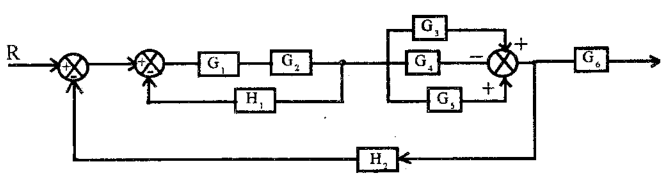

Figure : 2

(d) Calculate the sensitivity of the closed loop system shown in figure : 3 with respect to the forward path transfer function at $\omega = 1.5$ rad/sec.

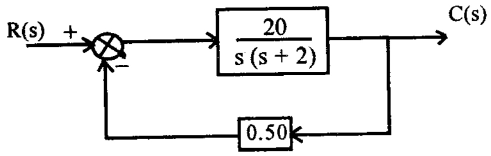

Figure : 3

(e) Discuss the effect of feedback on :

(i) Overall gain

(ii) Stability

(iii) Noise and Disturbance.

(f) What is the effect of PD (Proportional Derivative) Controller on steady– state error due to a unit ramp input in second order system ? Prove, mathematically.

2. Attempt any **three** parts of the following : **$(6\frac{2}{3} \times 3 = 20)$**

(a) Define the following terms of second order system :

(i) Delay time

(ii) Rise time

(iii) Peak time

(iv) Steady state error

(v) Settling time.

(b) Prove that the servomechanism system is a second order system i.e.

$$T(s) = \frac{Wn^2}{\left(S^2 + 2\xi WnS + Wn^2\right)}.$$

(c) The open loop transfer function of a unity feedback system is :

$$G(s) = \frac{\alpha}{s(1+\beta s)}.$$

For this system overshoot reduces form 0.6 to 0.2 due to change in α only. Show that :

$$\frac{(\beta\alpha_1 - 1)}{(\beta\alpha_2 - 1)} \cong 43 .$$

Where α_1 and α_2 are values of α for 0.6 and 0.2 overshoot respectively.

(d) Derive the expression for :

(i) Rise Time

(ii) Peak overshoot time for the second order control.

(e) Find k_p, k_v, k_a for the system having :

(i) $G(s) = 10/s^2$ and $H(s) = 0.7$

(ii) $G(s) = \frac{5}{(s^2 + 3s + 5)}$ $H(s) = 0.6$.

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) Sketch the root locus for a system having :

$$G(s) = \frac{K}{(s + 1)} \text{ and } H(s) = \frac{(s + 1)}{(s^2 + 4s + 5)}.$$

and comment on the result.

(b) For a system having characteristic equation $2s^4 + 4s^2 + 1 = 0$, find the following :

(i) The number of roots in the left half of s-plane.

(ii) The number of roots in the right half of s-plane.

(iii) The number of roots on the imaginary axis. Use the Routh, Hurwitz Criterion.

(c) Describe the ac servomotors for control application.

4. Attempt any **two** parts of the following : **(10×2=20)**

(a) Define the following :

(i) Resonance frequency

(ii) Bandwidth

(iii) Cut-off rate

(iv) Phase margin

(v) Gain margin.

Also discuss the advantages of frequency domain analysis.

(b) A Unity feedback control system has :

$$G(s) = \frac{40}{s(s+2)(s+5)}.$$

Draw the Bode Plot. Find Gain Margin.

(c) For the G (s) = 1/s (s – 2), H (s) = 1, sketch the Nyquist plot and determine the stability of the system.

5. Attempt any **two** parts of the following : **(10×2=20)**

(a) Discuss the PI and PD controller with their applications, also find the different error constant for P, I and D.

(b) Define the following terms :

(i) State

(ii) State variables

(iii) State vector

(iv) State space

(v) State equation.

Also write the properties of state transition matrix.

(c) A feedback system has a closed loop transfer function $\frac{C(s)}{R(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$ construct the phase variable state model.