Total No. of Questions : 8]

SEAT No. :

P3373

[Total No. of Pages : 3

[5353] - 567

T.E. (Electrical) (Semester - II)

CONTROL SYSTEM - I

(2015 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer all questions.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Find the transfer function $V_o(s)/V_i(s)$ of the circuit shown in fig.1- a if L=1 H and C =1F **[7]**

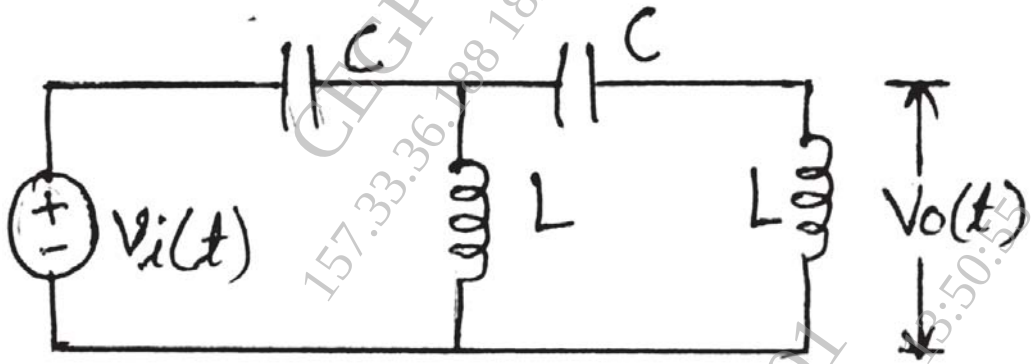

Fig. 1-a

b) Draw standard test signals. write expressions of standard test signals in time domain and write their laplace transform. for what purpose these signals are used? **[6]**

c) By means of Routh criterion, determine the stability of the system represented by the following characteristic equation $s^6+2s^5+8s^4+12\ s^3+20s^2+16s+16=0$ **[7]**

OR

P.T.O.

Q2) a) Using Mason's rule, find the transfer function T(s)= C(s) / R(s) for the system represented in the Fig. 2-a **[7]**

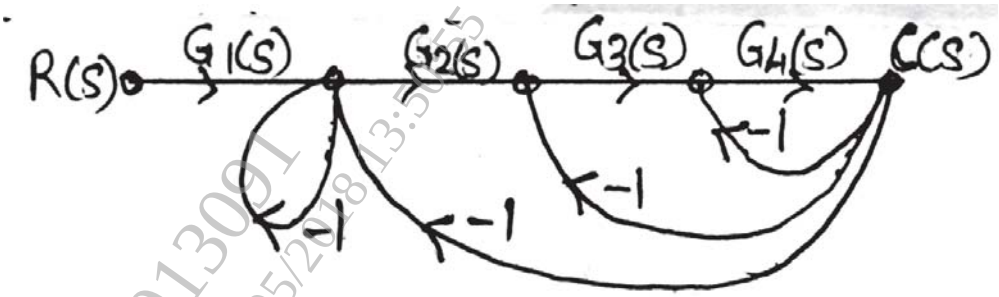

Fig.2-a

b) Derive expression for rise time and peak overshoot for a second order underdamped system for unit step input. **[6]**

c) Sketch the root locus of the unity feedback system having $G(S)=\frac{k}{s(s+2)(s+4)}$ where k is varied from 0 to ∞. Hence obtain the value of k for which the system is unstable. **[7]**

Q3) a) Draw polar plot of the given system **[10]**

$$G(s)\,H(s)=\frac{60}{(s+1)(s+2)(s+5)}$$

Find the frequency and the magnitude of G(s)H(s)

i) at which the plot intersects y axis

ii) at which the plot intersects x axis

b) Explain with sketch the contour which encloses entire right half of S-plane and State Nyquist stability criteria. **[6]**

OR

Q4) a) Consider the following open loop system **[8]**

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

Draw Nyquist plot and comment on the stability of closed loop system

b) Draw a typical frequency response magnitude characteristics and explain frequency response specifications. And also write relation between time and frequency response for second order system. **[8]**

Q5) a) The open loop unity feedback system is **[12]**

$$G(s) = \frac{2000}{s(s+1)(s+100)}$$ Draw Bode plot, determine the following and comment on the stability

i) Gain cross over frequency

ii) Phase cross over frequency

iii) Gain margin

iv) Phase margin

b) Explain how to draw the Bode magnitude and phase angle plots of a quadratic pole **[6]**

OR

Q6) a) The open loop unity feedback system is **[12]**

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

Draw Bode plot and determine

i) The value of k for gain margin of 7 db.

ii) The value of k for phase margin of 40°.

b) Explain the concept of gain margin and phase margin. Explain how these values help in studying relative stability. Mark phase and gain margin on Bode plots for an unstable system **[6]**

Q7) a) Design PID controller for unity feedback system given below using Zeigler-Nichols tuning method **[8]**

$$G(s) = \frac{1}{s(s+1)(s+3)}$$

b) Derive the transfer function of armature control D.C. servo motor. **[8]**

OR

Q8) a) Draw block diagram of PID controller and write the expression for output signal from PID controller in time domain. Explain effect of Proportional, integral and derivative control on rise time, peak overshoot, setting time and steady state error **[8]**

b) Draw the circuit diagram of lead compensator network and derive transfer function also plot pole zero locations in S- plane **[8]**