Printed Pages : 4

EEE-502

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

PAPER ID : 121504

Roll No.

# B. Tech.

## (SEM. V) (ODD SEM.) THEORY EXAMINATION, 2014-15

## CONTROL SYSTEM

Time : 3 Hours] [Total Marks : 100

1 Attempt any **four** parts : 5×4=20

(a) Explain various standard test signals, and also find relation between them.

(b) Draw time domain response curve of a second order system and indicate important specification.

(c) Derive an expression for $K_P$, $K_V$ and $K_A$ for type-1 system.

(d) A unity feedback system has a forward path transfer function $G(s)=\frac{(s+2)}{s(s+1)}$, determine rise time, peak time and settling time (2% tolerance).

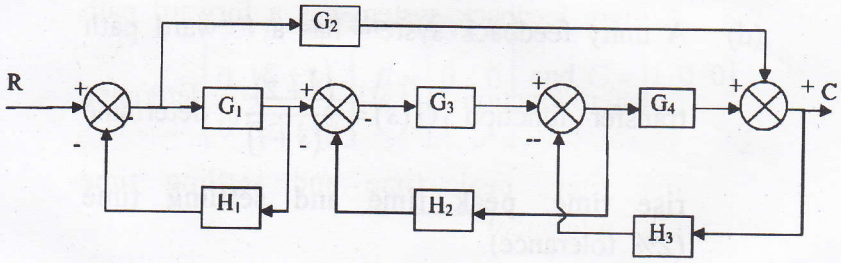
(e) A unity feedback system has transfer function $G(s)=\dfrac{K}{s(s+2)\left(s^2+2s+5\right)}$, determine steady state error if input is $r(t)=2+4t+\dfrac{t^2}{2}$.

(f) Write a short note on proportional derivative compensator stating its merits and demerits.

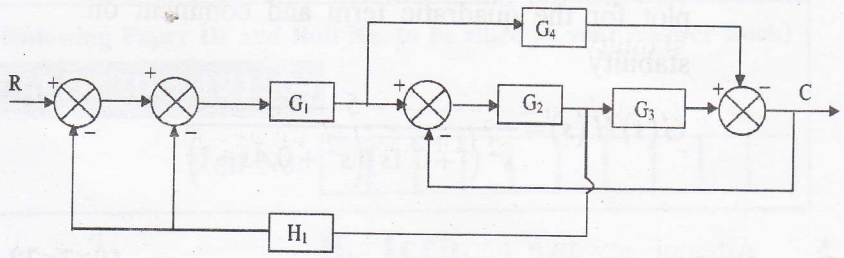
2 Attempt any **two** parts : **10×2=20**

(a) Give Comparison between open loop and closed loop systems. The impulse response of unity feedback close loop system is, $c(t)=-te^{-t}+2e^{-t}$, find its open loop transfer function.

(b) Reduce the block diagram shown below to a single block representation.



(c) Draw the signal Flow Graph and determine the overall transfer Function of the block diagram shown below.




3 Attempt any **two** parts : **10×2=20**

(a) Explain Construction and working of ac servomotor.

(b) Determine the Stability of a closed loop control system whose characteristic equation is $s^5+s^4+2s^3+2s^2+11s+10=0$.

(c) Sketch the root locus for the open loop transfer function of a unity feedback control system given below and determine, value of $K$ at $\xi=0.5$.

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

4 Attempt any **two** parts : **10×2=20**

(a) What is Nyquist Stability criterion? Explain Phase margin and Gain margin in polar plot.

(b) Draw the Nyquist plot for the open loop transfer function given below and comment on closed loop stability $G(s)H(s)=\frac{1.5(s+4)}{s(s-2)}$.

(c) Draw the bode plot for the transfer function given below, apply correction to the magnitude plot for the quadratic term and comment on stability

$$G(s)H(s)=\frac{5}{s^2(1+0.1s)\left(s^2+0.4s+1\right)}$$

5 Attempt any **two** parts : **10×2=20**

(a) For the open loop transfer function, $G(s)H(s)=\frac{10}{s(1+0.2s)}$ design a suitable compensator such that the system will have a phase margin of at least 45°.

(b) Determine the State model from transfer function of a system given as

$$\frac{Y(s)}{U(s)}=\frac{s^2+3s+2}{s^3+9s^2+26s+24}$$

(c) Check the controllability and observability of a system having following coefficient matrices,

$$A=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ 0 & 2 & -3\end{bmatrix}, B=\begin{bmatrix}0 & 1\\ 0 & 0\\ 1 & 1\end{bmatrix} \text{ and } C=\begin{bmatrix}1 & 0 & 0\end{bmatrix}.$$