B.E. / B.Tech (Part Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2014

ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH

THIRD SEMESTER

PTEC 285 / PTEC 334 / PTEC 9254 – CONTROL SYSTEMS

(REGULATIONS 2002/2005/ 2009)

Time: 3 Hours Max. Marks:100

Answer All Questions

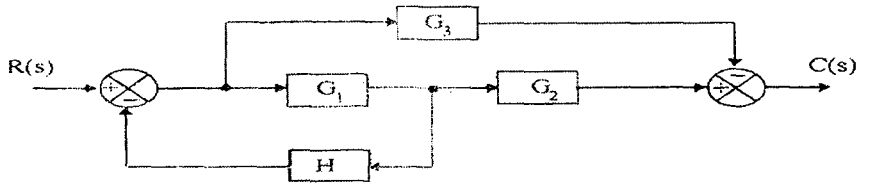
PART-A (10x2=20)

1. Define the Mason's gain formula.
2. A unity feedback system has an open-loop transfer function $G(s) = \frac{K}{S(S+10)}$. If the dampinratio is 0.5, Determine
   (i) The value of K
   (ii) Peek overshoot
3. Name the test signals used in time response analysis.
4. Why compensation is necessary in feedback control system?
5. Give the importance of unit circle property in Z-plane.
6. Define gain cross-over and corner frequency?
7. State Routh-Hurwitz criterion.
8. Define the term "breaking point".
9. Write the solution of non-homogeneous state equations.
10. Derive the expression for the transfer function from the state model

$\dot{x} = Ax + Bu$ $\quad y = Cx + Du$

PART-B (5x16=80)

11. Convert the given block diagram to signal flow graph and determine $\frac{C(S)}{R(S)}$ (16)



12 (a) Draw explain the detail block diagram of PID controller. Derive the necessary equations for the effective functionality. (16)

(OR)

(b) The open loop transfer function of a servo system with unity feed back system is G(S) = 10/ S(0.1S+1). Evaluate the static error constants of the system.

Obtain the steady state error of the system, when subjected to an input given polynomial $r(t) = a_0 + a_1 t + a_2 /2t^2$ (16)

13 (a) Sketch the Bode plot for the following transfer function, and determine the system gain 'K' for the gain cross-over frequency to be 5 rad / sec. (16)

$$G(s) = \frac{Ke^{-0.1s}}{s(1+s)(1+0.1s)}$$

(OR)

(b) Sketch the polar plot for the following transfer function and find Gain cross over frequency, Phase cross over frequency, Gain margin and Phase margin. (16)

$$GH(S) = 2(S+1) / S^2$$

14. (a) Consider a feedback system having the characteristic equation,

$$1 + \frac{K}{(1+S)(1.5+S)(2+S)} = 0$$

It is desired that all roots of the characteristic equation have real parts less than 1. Extend the Nyquist stability criterion to find the largest value of 'K' satisfying this condition. (16)

(OR)

(b) A unity feedback control system has an open loop transfer function $G(S) = K / S(S^2+4S+13)$. Sketch the root locus. (16)

15.(a) Give that $A_1 = \begin{bmatrix} \sigma & 0 \\ 0 & \sigma \end{bmatrix}$; $A_2 = \begin{bmatrix} 0 & \omega \\ -\omega & 0 \end{bmatrix}$; $A = \begin{bmatrix} \sigma & \omega \\ -\omega & \sigma \end{bmatrix}$. Compute e^{At}. (16)

(OR)

(b) (i) State and prove the controllability and observability conditions. (8)

(ii) A feedback system has the following transfer function $\frac{C(S)}{R(S)} = \frac{10S}{(S+1)(S+2)(S+3)}$.

Construct the state model for this system. (8)