11.5.19

B.E./B.Tech (Full Time) End Semester Examinations, April/May 2019
Fifth Semester
Electrical and Electronics Engineering

EE 8501- CONTROL SYSTEMS

Time:Three hours (R2012) Max: 100 marks

Answer ALL Questions

PART-A (10 x2 = 20 Marks)

1. What is transfer function?
2. Define linear system.
3. List out the standard test signals along with their characteristic curves, used in control systems.
4. How do you find real axis break away points?
5. Draw the polar plot for $G(s) = k/s^3$.
6. What is M Circles?
7. Define BIBO stability.
8. What is Controllability?
9. Mention the effects of lag compensation.
10. What is process reaction curve? How it is used in controller design?

PART-B (5 x 16 = 80 Marks)

11. A unity feedback system has the open loop transfer function, $G(s) = k/[s(s+1)]$. Design a suitable lead compensator for the system is to meet the following specifications:
    i) Steady state error due to ramp input $\leq 10\%$
    ii) Phase Margin $\geq 35^0$.

12(a) Convert the Block diagram of the system given in fig.12(a) into a Signal Flow Graph and determine the transfer functions $C_1(s)/R_1(s)$ and $C_2(s)/R_1(s)$ assuming $R_2=0$, using Mason's Formula.

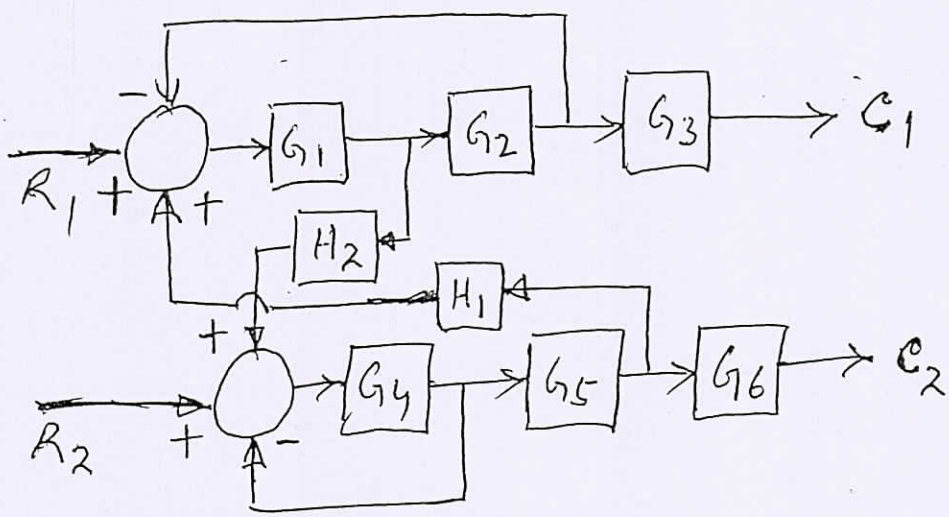

Fig 12(a)

(OR)

12(b) Using Block Diagram Reduction Technique, obtain C/R of the system given in fig.12 (b).

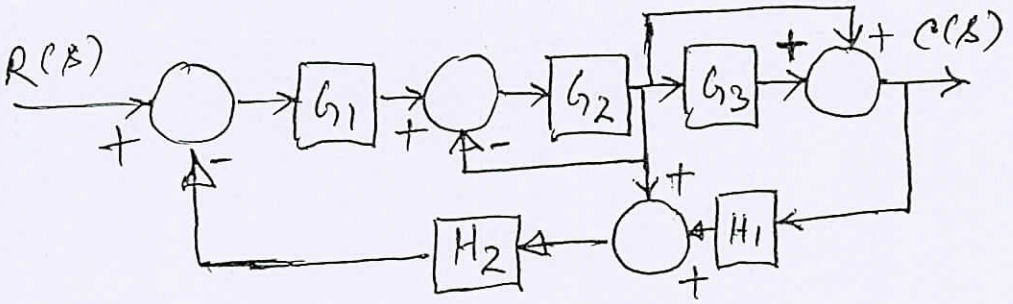

fig 12(b)

13(a) A feedback system has the forward path and the feedback path transfer function G(s) = 16/[s(s+0.8)], H(s)=(1+ks) respectively. Determine the value of k so that the damping ratio is 0.5. With this value of k, obtain the rise time, peak time, peak overshoot and settling time and also an expression for transient response due to a unit step input.

(OR)

13(b) A unity feedback system has the loop transfer function

$$G(s) = k(s+3)/[(s(s+4)(s+5)(s^2+2s+2)].$$

Sketch the Root Locus showing all the relevant points. Find the breakaway point and imaginary axis crossover point.

14(a) Sketch the Bode plots for a control system whose loop transfer function is G(s) = 500(s+2)/[s(s+1)(s+5)(s+20)]. Determine GM and PM.

(OR)

14(b) Sketch the Nyquist plot for a unity feedback system whose open loop transfer function is G(s) = 20/[s^2(s+2)(s+4)]. Examine the closed loop stability.

15(a) For a control system having transfer function C(s)/R(s)=5/[s(s+1)(s+2)]. Obtain the state equations and hence the state transition matrix. Also write the expression for the output c(t) if the input r(t)=u(t).

(OR)

15(b) A system is described by the following equations

$$\dot{x} = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 1 \end{bmatrix} x \quad \& \quad x(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

Obtain the state transition matrix and the solution y(t) if the input u(t) is a step function.