(Pages : 4)

Reg. No. : ....

Name : ....

Sixth Semester B.Tech. Degree Examination, May 2013
(2008 Scheme)
08.603 : CONTROL SYSTEMS (T)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **(4×10=40 Marks)**

1. How to check stability using Nyquist s stability criterion ?

2. What is the principle of operation of a lag compensator ?

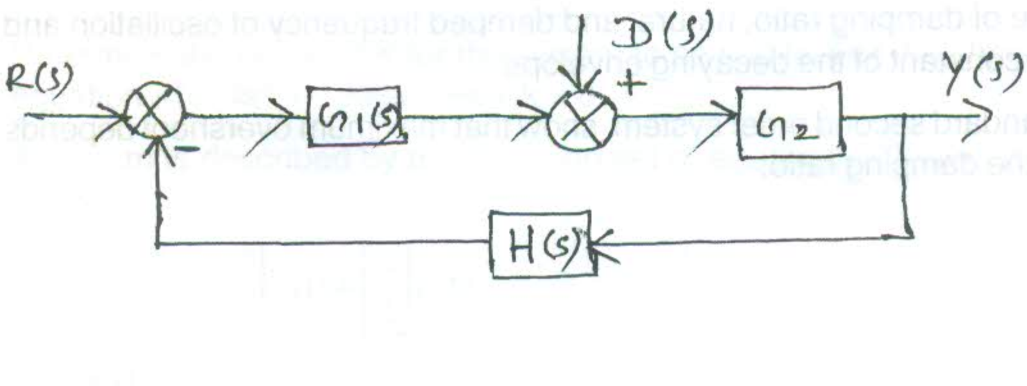
3. Check whether the following points are on root locus for the system with open loop transfer function

$$G(s)\,H(s) = \frac{K}{(s+1)\,(s+2)\,(s+3)}$$

a) $s = -2.5$ b) $s = -1 \pm j\sqrt{2}$. If so, find the value of K at these points.

4. Mark down positive and negative gain margins and phase margins with respect to a Bode plot. What it indicates ?

5. Find the transfer function of the system shown below with R(s) and D(s) are inputs and C(s) as output.



6. A unity negative feedback control system has the plant $G(s) = \frac{K}{s(s+\sqrt{2}\sqrt{k})}$.

Determine percentage overshoot and settling time (2% criteria) due to a unit step input. For what range of K is the settling time less than 1 second.

7. The open-loop transfer function of a unity feedback control system is given by $G(s) = \frac{K}{s(s^2+4s+20)}$. Specify the type of the system. Find steady state errors. Assuming that the system is stable.

8. The open-loop transfer function of a unity feedback discrete time system is given by $GH(z) = \frac{K(0.368z+0.264)}{z^2-1.36z+0.368}$. Determine the range of K for stability.

9. Write force-voltage analogous quantities. What is the usefulness of analogous transfer function ?

10. What is the importance of frequency response analysis in control systems ? Compare the features of Bode plot and Nyquist plot.

PART – B

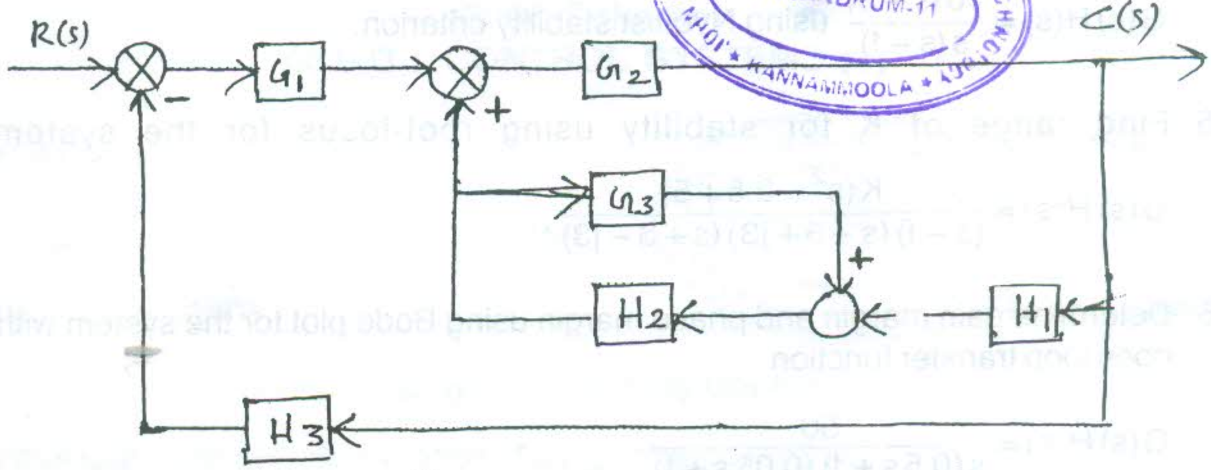
Answer **any two** questions from **each** Module. **(10×6=60 Marks)**

Module – I

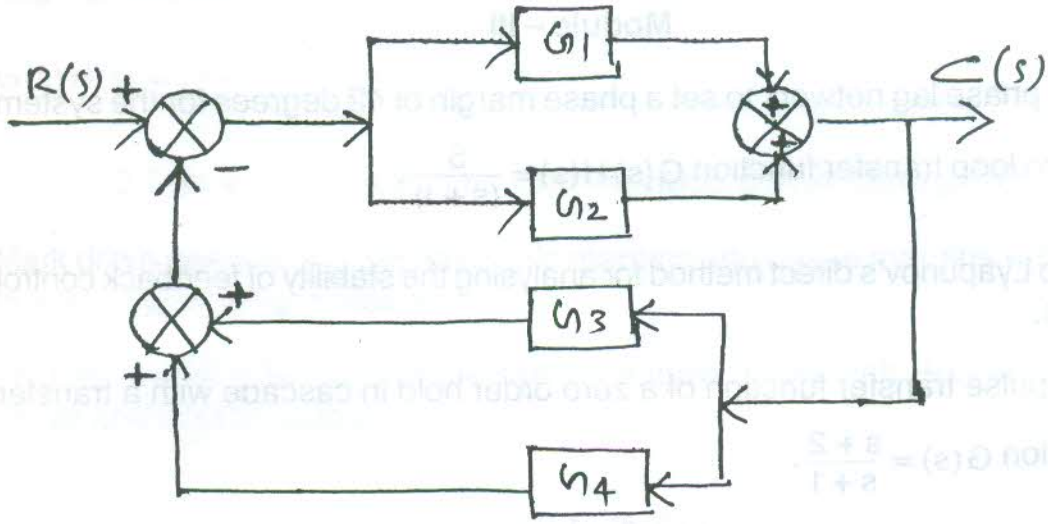
11. a) For the second order system transfer function $\frac{C(s)}{R(s)} = \frac{180}{s^2+19.6s+196}$. Find the value of damping ratio, natural and damped frequency of oscillation and the time constant of the decaying envelope.

b) For a standard second order system, show that maximum overshoot depends only on the damping ratio.

12. a) Apply Mason's gain formula to find transfer function for the block diagram given below.



b) Using block diagram reduction technique simplify the following block.



13. a) Determine the range of K for the system to be stable. For the characteristic equation $s^4 + 4s^3 + 13s^2 + 36s + k = 0$.

b) A system is described by the following set of equations. Derive its transfer function.

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

$$Y(t) = \begin{bmatrix} 1 & 0 \end{bmatrix} x(t)$$

Module – II

14. Check the stability of the system with open loop transfer function

$$G(s)\,H(s) = \frac{10\,(s+3)}{s\,(s-1)}$$ using Nyquist stability criterion.

15. Find range of K for stability using root-locus for the system

$$G(s)\,H(s) = \frac{K\,(s^2 - 2.5 + 5)}{(s-1)\,(s+3+j3)\,(s+3-j3)}.$$

16. Determine gain margin and phase margin using Bode plot for the system with open loop transfer function

$$G(s)\,H(s) = \frac{50}{s\,(0.5\,s+1)\,(0.05\,s+1)}$$

Is the system stable ?

Module – III

17. Select a phase lag network to set a phase margin of 42 degrees for the system with open loop transfer function $G(s)\,H(s) = \frac{5}{(s+1)}$.

18. Describe Lyapunov's direct method for analysing the stability of feedback control systems.

19. a) Find pulse transfer function of a zero order hold in cascade with a transfer function $G(s) = \frac{s+2}{s+1}$.

b) Determine f(kT), given $F(z) = \frac{0.792\,z^2}{(z-1)\,(z^2 - 0.416\,z + 0.208)}$.
