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Reg. No. : ....

Name : ....

Sixth Semester B.Tech. Degree Examination, April 2014
(2008 Scheme)
08.603 : CONTROL SYSTEMS (T)

Time: 3 Hours Max. Marks: 100

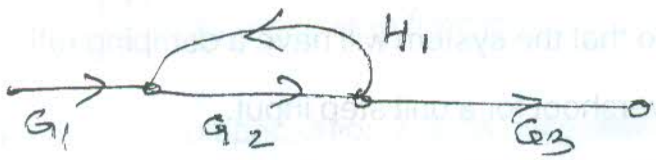
PART – A

Answer **all** questions :

1. The Laplace transform of error signal of a control system is characterised by $E(s) = R(s)\dfrac{S}{S^2+8S+40}$. Calculate the steady state value of error if r(t) = t.

2. The impulse response of a system is given by $g(t) = e^{-t}(1-\cos 2t)$. Determine the transfer function of the system.

3. Obtain the ratio X_4/X_1 if the SFG is



4. How stability is determined using Routh-Hurwitz criteria ?

5. A unity feed back system has an open-loop transfer function $G(S) = \dfrac{K}{S(S^2+4S+13)}$.

   Find

   a) Centroid and angle of asymptotes.

   b) Angle of departure from the poles.

6. State Nyquist criteria for stability. Define gain margin and phase margin with respect to Nyquist plots.

P.T.O.

7. State the advantages of state space representation.

8. Define Eigen values of a vector. Obtain the eigen values for a square matrix

$A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$.

9. Name the various controllers used. Obtain the transfer function of the controllers.

10. State the advantages of digital control system. State at least one example.

(10×4=40 Marks)

PART – B

Answer **any 2** questions from **each** Module :

Module – 1

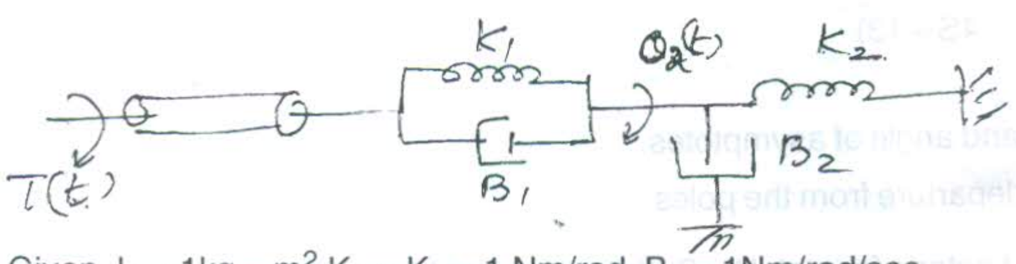
11. a) The open loop transfer function of a unity feedback system is

$G(S) = \dfrac{K(S+3.15)}{S(S+1.5)(S+0.5)}$. Determine the type and order of the system. Find all the error coefficients and steady state errors corresponding to it. 5

b) A unity feedback system is characterised by a loop transfer function $\dfrac{K}{S(S+10)}$. Find the value of K, so that the system will have a damping ratio 6.5. Obtain settling time, peak overshoot for a unit step input. 5

12. Obtain the state space representation of a dc armature controlled motor. 10

13. For the rotational system shown in figure. Find the transfer function $\dfrac{Q_2(s)}{T(s)}$.



Given $J_1 = 1\text{kg} - \text{m}^2$ $K_1 = K_2 = 1$ Nm/rad $B_2 = 1$Nm/rad/sec. 10

Module – 2

14. Draw the Nyquist plot and investigate the stability. The open loop transfer function is given by $G(S)\,H(S) = \dfrac{K}{(S+1)\,(S+2)}$. **10**

15. Sketch the Bo de plot for the open-loop transfer function $\dfrac{200\,(S+2)}{S(S^2+10S+100)}$.
Is the system stable ? Give reasons for the answer. **10**

16. Sketch the root locus plot for a negative feedback system having an open-loop transfer function $G(S)\,H(S) = \dfrac{K\,(S+9)}{S(S+2)\ (S+4)}\ K \geq 0$. Find the range of K for closed loop stability. **10**

Module – 3

17. Solve for X(t) using the state equation given below :

$$\dot{X}(t) = \begin{bmatrix} 0 & 1 \\ -8 & -6 \end{bmatrix} X(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t).$$

$X\,[0] = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ u(t) = unit step function. **10**

18. What is lag compensation ? Draw a lag network and derive its design equations. **10**

19. A system is described by

$$\dot{X} = \begin{bmatrix} 1 & -1 \\ 1 & -1 \end{bmatrix} X + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$Y = [\,1 \quad 0\,]\, u.$
Check the controllability and observability of the system. **10**
