B.E. / B.Tech. Electrical (Electronics & Power) Engineering (Model Curriculum) Semester-V

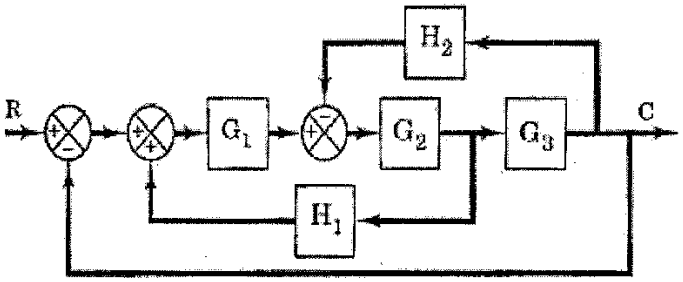
TE105 - Control Systems

P. Pages : 3 **GUG/W/24/13868**

Time : Three Hours * 5 5 0 4 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. answer **any five** questions as per internal given choice.
3. . Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of non-programmable calculator is permitted.

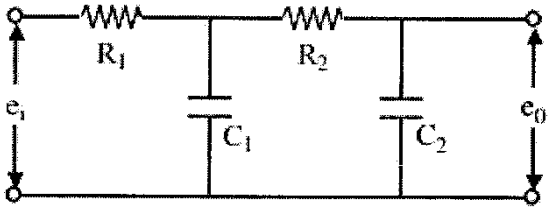
1. a) Obtain the Transfer function of following Block Diagram. **8**



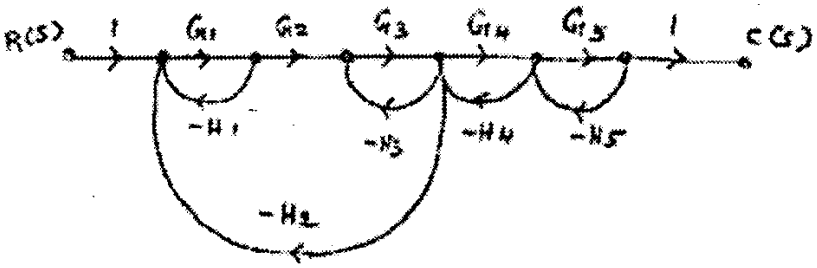
b) Discuss basis for framing the rules of block diagram reduction technique? What are drawbacks of the block diagram reduction technique? **8**

OR

2. a) Find the transfer function of the following network. **8**



b) Obtain the closed loop transfer function of the systems, by using Mason's gain formula. **8**



3. a) Derive the expression for **9**
i) Rise time
ii) Maximum overshoot.
iii) Peak time

b) The open loop transfer function of a unity feedback control system is given by: **7**

$$G(s)=\frac{k(s+2)}{s^3+\beta s^2+4s+1}$$

Determine the value of k & β such that the close-loop unit step response has $w_n = 3\text{rad/sec}$ and $\xi = 0.2$.

OR

4. a) The open-loop transfer function of a unity feedback control system is given by **8**

$G(s)=\frac{5(s+1)}{s^2(s+4)}$. Determine the steady state error if the input is $r(t)=2-t+2t^2$.

b) The impulse response of a system is $c(t)=-te^{-t}+2e^{-t}\,(t>0)$. Find its open loop transfer function. **8**

5. a) Determine the stability of a system whose overall transfer function is given below **8**

$$\frac{C(s)}{R(s)}=\frac{2s+5}{s^5+1.5s^4+2s^3+4s^2+5s+10}$$

If the system found unstable, how many roots it has with positive real part?

b) Sketch the root locus plot for the open-loop transfer function given below. **8**

$$G(s)H(s)=\frac{k(s^2+4)}{s(s+2)}$$

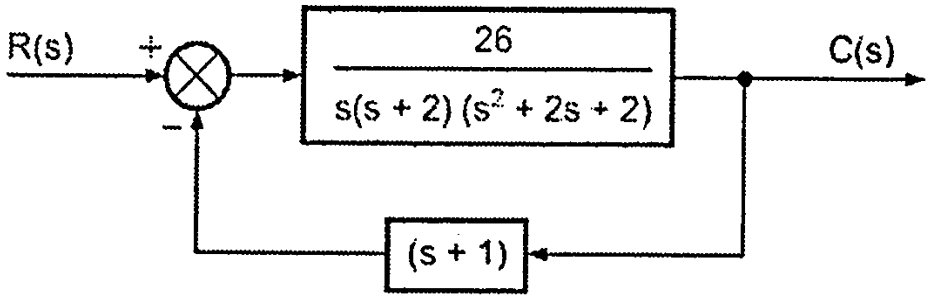
Calculate the value of K at

i) Breakaway point

ii) s = – 0.69 + j0.9

OR

6. a) Determine the number of roots having positive real part of the characteristic equation whose block diagram is shown in fig. **8**



b) With the help of Routh's stability criterion determine the stability of the following systems represented by the characteristics equations: **8**

a) $s^5+s^4+2s^3+2s^2+3s+5=0$

b) $9s^5-20s^4+10s^3-s^2-9s-10=0$

7. a) Sketch the asymptotic bode plot for the transfer function given below. **8**

$$G(s)H(s)=\frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

from the Bode plot determine

ω_{pc}, ω_{ge} P.M. and G.M.

Is the system stable?

b) List out the frequency domain specification of a standard second order system. Derive the expression for Resonant peak and Bandwidth of a second order system. **8**

OR

8. a) The open loop transfer function of unity feedback control system is given below: **8**

$$G(s)=\frac{(s+0.25)}{s^2(s+1)(s+0.5)}$$

Determine the closed-loop stability by applying Nyquist Criterion.

b) Draw the polar plot for the closed loop system having the following open loop transfer function and determine whether system is stable or not. **8**

$$G(s)H(s)=\frac{100}{s(1+2s)(1+s)}$$

9. a) Explain the advantage of state space analysis method over transfer function and derive the expression of state space model to transfer function. **8**

b) Find a state model for the system whose Transfer function is given by **8**

$$G(s)H(s)=\frac{\left(7S^2+12S+8\right)}{\left(S^3+6S^2+11S+9\right)}$$

OR

10. a) Find the state model of the differential equation is **8**

$\dddot{y}+2\ddot{y}+3\dot{y}+4y=u$

b) A system is characterized by the following state space equations: **8**

$\dot{X}_1=-3x_1+x_2;\ \ \dot{X}_2=-2x_1+u;\ Y=x_1$

a) Find the transfer function of the system and stability of the system.

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