

- iv) The location of the closed loop conjugate pair of pole on $j\omega$ axis indicates that the system is
- a) stable
 - b) unstable
 - c) marginally stable
 - d) critically stable.
- v) Gain margin is the reciprocal of the gain at the frequency at which the phase angle is
- a) 90°
 - b) 180°
 - c) -180°
 - d) 0°
- vi) The disadvantage(s) of polar plot is (are)
- a) the calculations are time consuming for exact plot
 - b) it is very difficult to calculate gain and phase margins
 - c) plot is cramped at high frequencies
 - d) all of these
- vii) The characteristic equation of an armature controlled dc motor is
- a) first-order equation
 - b) second-order equation
 - c) zero-order equation
 - d) third-order equation
- viii) The transfer function of a system is its
- a) square wave response
 - b) step response
 - c) ramp response
 - d) impulse response.
- ix) The concept of analogous system is applicable to
- a) linear system only
 - b) non-linear system only
 - c) both linear and non-linear systems
 - d) non-linear systems but can be extended to linear systems too.

- x) PID controller improves the
- steady-state response only
 - transient response only
 - both steady state response and transient response only
 - none of these.
- xi) The Nyquist criterion for determination of stability of control system is
- algebraic method
 - graphical method
 - semi-graphical method
 - none of these.
- xii) The transfer function of a basic PI controller is given by (all K's are real constants)
- $K_0 + K_1/S + K_2S$
 - $K_0 + K_2S$
 - $K_1/S + K_2S$
 - $K_0 + K_1/S$
- xiv) If M_p is 100%, the damping ratio is
- 1
 - 0
 - 0.5
 - infinity.

GROUP – B

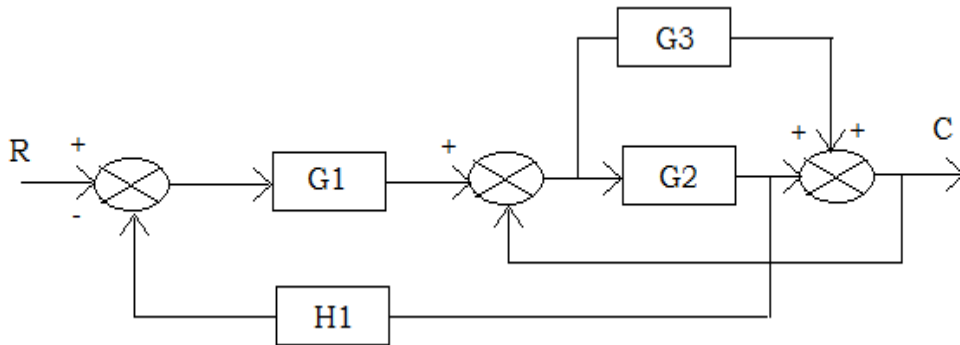
(Short Answer Type Questions)

Answer any *three* of the following.

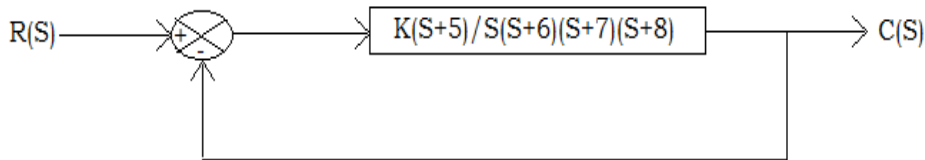
3 x 5 = 15

2. For the characteristics equation of feedback control system given as $s^4 + ks^3 + 5s^2 + 10s + 10k = 0$, Calculate the range of 'k' for stability. Also find the value of 'k' so that the system is marginally stable.

3. Determine the transfer function relating C and R for the block diagram given below. Use Mason's gain formula.



4. Find the value of gain K, such that the following system has a 10% steady-state error for ramp input.



5. A unity feedback system has $G(S)=180/S(S+6)$ and $r(t)=4t$.

Determine:

- (a) steady state error
- (b) the value of k to reduce error by 6%. 3+2
6. A unity feedback system has an open-loop transfer function $G(S)=25/S(S+8)$. Determine its damping ratio, peak overshoot and time required to reach peak.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.

3 x 15 = 45

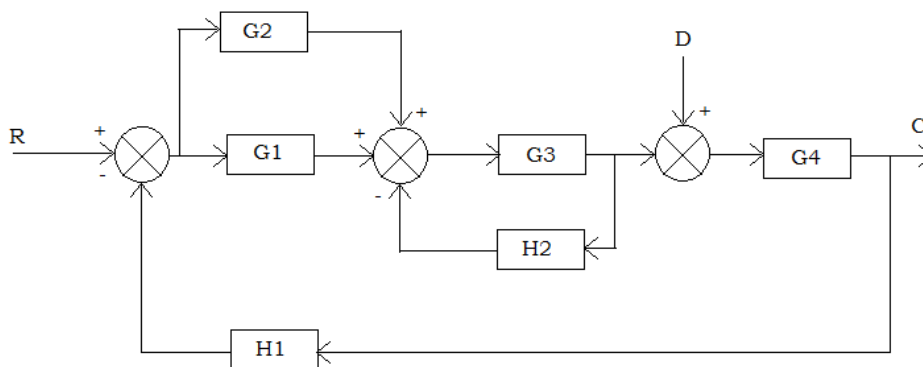
7. Explain the meaning and significance of phase margin and gain margin of a control system. How will you obtain the values of these margin from Bode plots?

Draw the Bode plots for a system having the open loop transfer functions

$$G(S) H(S) = \frac{5}{S(S+1)(S+2)}$$

Determine:

- a) Gain crossover frequency,
 - b) Phase crossover frequency,
 - c) Gain margin
 - d) Phase margin and
 - e) Stability of the closed-loop system.
8. Determine the ratio C/R, C/D and the total output for the system whose block diagram is shown below.



Write down the advantages and disadvantages of open loop system and closed loop system. What is transfer function.

8+5+2

9. Determine the peak time, maximum percentage overshoot and setting time for a system whose transfer function is given by

$$G(S) = \frac{25}{S^2 + 5S + 25}$$

A system having the characteristic equation given below:

$$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$$

- a) Determine whether the system is stable or not.
- b) Determine how many roots are presents in the imaginary axis.

- c) Determine how many roots are present in the negative real axis. (3×3)+(3×2)

10. a) What do you mean by root locus?

- b) Draw the root locus for the open-loop transfer function given by

$$G(S) H(S) = \frac{K}{S(S+4)(S^2+4S+20)} \quad 3+12$$

11. a) Using Nyquist criterion investigate the closed-loop stability of the system whose open-loop transfer function is given below:

$$G(S) H(S) = K(S+1)/(S+0.5) (S-2)$$

- b) What are steady state errors? How is it related to type of the system? 8+7

12. Write short notes on any *three* of the following: 3 x 5

- a) Damping factor
- b) PID Controller
- c) Relative stability
- d) Pole locations in s-plane and effect on time response and stability.
- e) Static error co-efficients.

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