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CONTROL SYSTEM-18EC43(Question Bank)

1. Mention any six differences between closed loop and open loop control systems.
2. List the characteristics of good control systems.
3. What are analogous systems? What are the advantages of studying non electrical systems in terms of their electrical analogs.
4. Define Transfer function. Explain Mason's gain formula for determining the transfer function from signal flow graph.
5. Define the following related to signal flow graph.
   i)Forward path ii) Feedback loop iii) Self loop iv) Path gain.
6. Derive an expression for the under damped response of a second order feedback control system for step input.
7. Derive the equation for steady state error of simple closed loop system.
8. Derive an expression for maximum overshoot (M_p) and peak response time(T_p) of an under damped second order control system subjected to unit step input.
9. With the help of graphical representation and mathematical expression, explain the following test signals. i)Step signal ii) Ramp signal.
10. State and explain Routh-Hurwitz criterion. Mention its limitations.
11. State and Prove the theorem on BIBO stability.
12. Define the following i) State ii) State Variables iii)State vector.
13. Define STM. List the properties of state transition matrix.
14. What is signal reconstruction? Explain with sample and hold circuit(ZOH).
15. Define the following as applied to Bode plots
    i)Gain Margin ii) Phase Margin iii) Gain cross over frequency
16. Explain briefly the following terms with respect to Root Locus technique. i) Centroid ii) Asymptote iii) Break Away point.
17. Using RH criteria determine the stability of the system having the characteristic equation
    $s^6+ 2s^5 + 5s^4+8s^3+8s^2+8s +4=0$.

18. Compute the state transition matrix $\emptyset(t)$ of the system having state model,

$$\dot{X}(t)=\begin{bmatrix} 0 & -1 \\ +2 & -3 \end{bmatrix}X(t)$$

19. The transfer function of a control system is given by $\frac{\mathbf{y(s)}}{\mathbf{u(s)}} = \frac{\mathbf{s^2+3s+4}}{\mathbf{s^3+2s^2+3s+2}}$. Obtain its state model.
20. A unity feedback control system is characterized by the open loop transfer function **G(s)=** $\frac{\mathbf{K(s+13)}}{\mathbf{s(s+3)(s+7)}}$. i) Using the Routh's criterion, calculate the range of values of K for the system to be stable. ii)Check if all the roots of the characteristic equation of the above system are more negative than -0.5 for K=1.
21. Find whether **S= -0.75** and **S = -1+j4** is on the root locus or not for the system having **G(s)H(s)=** $\frac{\mathbf{K}}{\mathbf{s(s+2)(s+4)}}$ using angle condition. If so find the value of K.
22. Consider the system described by $\dddot{y}(t)$+9$\ddot{y}$(t)+26$\dot{y}(t)$ + 24*Y(t)* = 6 U(t). Obtain its state model. Also draw state diagram.
23. For a UFBCS with **G(s)=**$\frac{\mathbf{10(s+2)(s+3)}}{\mathbf{s(s+1)(s+4)(s+5)}}$. Compute i)The static error coefficients ii)Steady state error when the input is **r(t)=3+t+t^2** iii)TYPE of the system.
24. A system with G(s)=K_1/ S^2 and H(s)= 1+K_2S, determine the value of K_1 and K_2 so that peak overshoot to a unit step input is 0.25 and peak time is 2sec.
25. For a unity feedback control system with **G(s)=**$\frac{\mathbf{64}}{\mathbf{s(s+9.6)}}$. Find the output response to a unit step input. Also determine i)The response at t=0.1sec ii)Settling time.
26. Mp and tp of a second order under damped system subjected to unit step input are 0.163 and 0.363sec respectively. Find the TF of the system.
27. What are Static error coefficients ? Derive the expressions for the same.
28. Compare i) linear and non linear control system and ii) time variant and time invariant control system.
29. For the characteristic equation $s^8 + s^7 + 4s^6 + 3s^5 + 14s^4 + 11s^3 + 20s^2 + 9s + 9 = 0$, determine the number of roots with +ve real part.
30. Obtain expressions for rise time, peak time and settling time for a second order feedback system for a step input(under damped case)