Reg. No. : | | | | | | | | | | |

Question Paper Code: 31352

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fifth Semester

Electrical and Electronics Engineering

01UEE502 - CONTROL SYSTEMS

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What are the basic properties of signal flow graph?
2. Define mathematical model of the system.
3. List the time domain specifications.
4. Why derivative controller is not used in control system?
5. What is phase and gain cross-over frequency?
6. Name the parameters which constitute the frequency domain specifications.
7. What is the necessary and sufficient condition for stability?
8. Derive the transfer function of a lead compensator network.
9. What is state and state variable?
10. Define state and state variable.

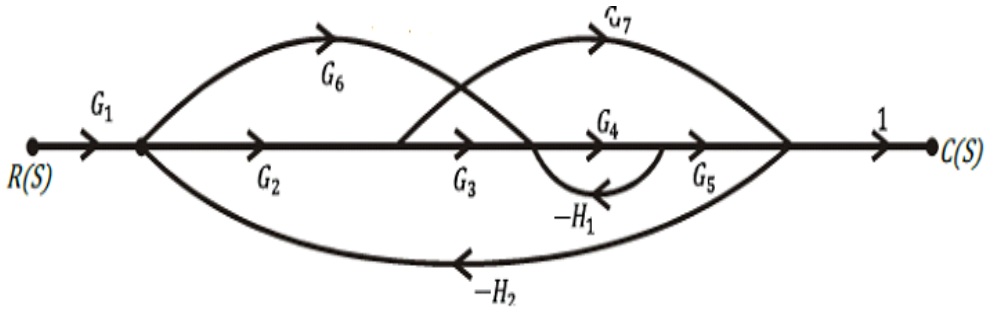
PART - B (5 x 16 = 80 Marks)

11. (a) (i) Explain the open loop and closed loop system with an example. (8)

(ii) Explain the working principle of AC Servomotor. (8)

Or

(b) Obtain the closed loop transfer function *C(S) / R(S)* by using Mason's Gain Formula. (16)



12. (a) For a unity feedback control system the open loop transfer function $G(s) = \frac{10(s+2)}{s^2(s+1)}$

Find (a) the position, velocity and acceleration error constants, (b) the steady state error when the input is R (s) where $R(s) = \frac{3}{s} - \frac{2}{s^2} + \frac{1}{3s^3}$. (16)

Or

(b) Sketch the root locus of the system whose open loop transfer function is $G(S) = \frac{K}{S(S+2)(S+4)}$. Find the value of *K* so that the damping ratio of the closed loop system is 0.5. (16)

13. (a) Sketch Bode plot for the following transfer function and determine the gain and phase cross over frequencies. $G(s) = \frac{10}{s(1+0.4s)(1+0.1s)}$. (16)

Or

(b) Consider a unity feedback system having an open loop transfer function $G(S) = \frac{K}{S(1+0.2S)(1+0.05S)}$. Sketch the polar plot and determine the value of *K* so that (i) Gain margin is 18 *db* (ii) Phase margin is 60 *deg.* (16)

14. (a) Use the routh stability criterion to determine the location of roots on the s-plane and hence the stability for the system represented by the characteristic equation.

$s^5 + 4s^4 + 8s^3 + 8s^2 + 7s + 4 = 0$. (16)

Or

(b) Determine the Nyquist plot for the system whose open loop transfer function is, $G(S)\,H(S) = \dfrac{K}{S\,(S+2)\,(S+10)}$. Determine the range of K for which closed loop system is stable. (16)

15. (a) The transfer function of a control system is given by $\dfrac{Y(S)}{U(S)} = \dfrac{(S+2)}{(S^3 + 9S^2 + 26S + 4)}$

Check For Controllability. (16)

Or

(b) A linear time-invariant system is characterized by homogeneous state equation. $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$. Compute the solution of the homogeneous equation, assuming the initial state vector, $X_\circ = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$. (16)
