G 1212 (Pages : 2) Reg. No.....

Name.....

SAINTGITS COLLEGE OF ENGINEERING LIBRARY KOTTAYAM

B.TECH. DEGREE EXAMINATION, MAY 2015

Sixth Semester

Branch : Electrical and Electronics Engineering

EE 010 603—CONTROL SYSTEMS (EE)

(New Scheme—2010 Admission onwards)

[Regular / Improvement / Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What is a gyroscope ? What are the different types and their applications ?
2. What is meant by frequency domain analysis ? Explain.
3. What are minimum phase and non-minimum phase systems ? Explain.
4. Realize lag compensator using Operational Amplifier. What is its transfer function ?
5. What are state variables and phase variables ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Explain how gain margin and phase margin can be obtained from bode plot ?
7. What is meant by polar plots ? What are steps to plot the polar plots ?
8. State and explain Nyquist stability criterion.
9. What is state transition matrix ? What are its properties ?
10. What are controllable and Observable canonical forms ?

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. The open loop transfer function of a system is given by :

$$G(s)\,H(s) = \frac{2}{s(1 + 0.5s)(1 + 0.05s)}.$$

Determine the phase–crossover frequency, Gain cross–over frequency, G.M. and P.M.

Or

Turn over

12. Sketch the polar plot for the transfer function : $G(s) = \dfrac{K}{s^2(1 + s\tau_1)(1 + s\tau_2)}$.

13. For a unity feedback system, $G(s) = \dfrac{5(s^2 + 2s + 100)}{s^2(s + 5)(s^2 + 3s + 10)}$. Find the step, ramp and parabolic error co–efficients.

Or

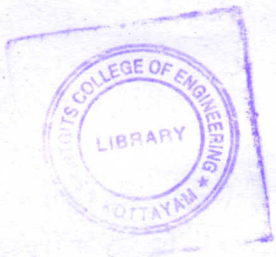
14. Using Nyquist stability criterion, comment on the stability of the system

$$G(s)\,H(s) = \frac{4s + 1}{s^2(s + 1)(2s + 1)}.$$

15. Design a suitable compensator using root locus technique for a system with open loop transfer function $G(s) = \dfrac{16}{s(s + 4)}$ so that, $K_v = 20\ \text{sec}^{-1}$ without having much change in the original pole locations.

Or

16. Design a suitable phase lag compensating network for $G(s) = \dfrac{K}{s(1 + 0.1s)(1 + 0.2s)}$ that will meet the specifications $K_v = 30\ \text{sec}^{-1}$ and P.M $\geq 40°$.



17. Diagonalize the matrix $A = \begin{bmatrix} 0 & 1 & -1 \\ -6 & -11 & 6 \\ -6 & -11 & 5 \end{bmatrix}$.

Or

18. Obtain the tranfer function of the state model :

$\dot{X} = AX + BU$ and $Y = CX + DU$ with commonly used notations.

19. Show that eigen values remain stationary under similarity transformation.

Or

20. (a) Find the state transition matrix $A = \begin{bmatrix} \sigma & -\omega \\ \omega & \sigma \end{bmatrix}$.

(b) For the system shown, find the response to unit step input with initial conditions :

$$x(0) = \begin{bmatrix} 0 \\ 0 \end{bmatrix}; \begin{bmatrix} \dot{x}_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u.$$

(5 × 12 = 60 marks)