(Pages : 3) **8019**

Reg. No. : .....

Name : .....

Sixth Semester B.Tech. Degree Examination, December 2009
(2003 Scheme)
Branch : Applied Electronics
03-605 : CONTROL SYSTEM THEORY (A)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Find the transfer function of a system represented by the differential equation

$$2\frac{d^2y}{dt^2} + 3y = \frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 5x .$$

2. Derive the mathematical model for a thermal system and find the transfer function.
3. State and explain Mason's gain formula for signal flow graphs.
4. What is relative stability and absolute stability ?
5. Linearize the non linear equation z = xy, in the region $4 \le x \le 6, 10 \le y \le 12$. Also find the error if the linearized equation is used to calculate the value of z when x = 4 and y = 10.
6. What is relative stability and absolute stability ?
7. What is polar plot ? Explain with an example of integral and derivative factors.
8. Explain the characteristics of lead compensation network.
9. What is a PID controller ?
10. Explain Zero-placement approach to improve response characteristics.

P.T.O.

PART – B

Answer **two** questions from **each** Module. **Each** question carries **10** marks.

Module – I

11. Derive the mathematical model for a liquid level system and then obtain the transfer function.

12. For the system represented by the following set of equations, find the transfer function $\frac{y(s)}{x(s)}$ using signal flow graph.

    i) $y = y_1 + \beta_3 x$

    ii) $y_1' = -a_1 y_1 + y_2 + \beta_2 x$

    iii) $y_2' = -a_2 y_1 + \beta_1 x$

13. Sketch the root locus plot for the feed back system whose open loop transfer function $G(s)\,H(s) = \frac{K}{s(s+2)\left(s^2+2s+2\right)}$.

Module – II

14. Consider the characteristic equation $s^4 + 2s^3 + (4 + K)\,s^2 + 11s + 13 = 0$. Using the Routh's stability criterion, determine the range of K for stability.

15. Construct Bode magnitude and phase diagrams for

$$G(s)\,H(s) = \frac{100(0.1s+1)}{s(s+1)^2\,(0.01s+1)}$$

Also comment on the closed loop stability of the system.

16. Sketch the Nyquist plot for $G(s)\,H(s) = \frac{s+2}{(s+1)\,(s-1)}$.

Module – III

17. The forward path transfer function of a certain unity negative feedback control system is $G(s) = \frac{K}{s(s+1)(s+25)}$

    The system has to satisfy the following specification

    a) Phase margin $\geq 30°$

    b) Gain margin $\geq$ 18 dB

    c) Steady state error for unit ramp input $\leq$ 20. Design a suitable lead compensator.

18. Sketch Bode diagram of PID controller. Also give an application for feed forward control system.

19. Discuss about Zero-placement approach to improve response characteristics.