Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SIXTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023
ELECTRICAL AND ELECTRONICS ENGINEERING
(2020 SCHEME)

Course Code : 20EET302

Course Name: Linear Control Systems

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Define transfer function.
2. Compare open loop and closed loop control systems.
3. How control systems are classified depending on the value of damping?
4. List the advantages of generalized error coefficients.
5. Discuss the effect of positive feedback in the root locus.
6. How will you find root locus on real axis?
7. How phase margin determined from bode plot?
8. What is Gain Margin and Phase Margin in polar plot?
9. Mention the need for lead and lag compensation.
10. State Nyquist stability criterion.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. Obtain the transfer function of Lead network and discuss about its frequency response. (14)

OR

12. Explain with neat diagram the principle and operation of Gyroscope and Synchro (14)

MODULE II

13. a) Derive the step response of undamped second order system. (7)
    b) The open loop transfer function of a unity feedback system is given by $G(s) = \frac{20}{s(s+2)}$. The input function is $r(t) = 2 + 3t + t^2$. Determine the generalized error coefficients and steady state error. (7)

OR

14. a) Construct R-H criterion and determine the stability of a system representing the characteristics equation. (7)
    $S^6+2S^5+8S^4+12S^3+20S^2+16S+16 = 0$

b) A unity feedback control system is characterized by the following open loop transfer function $G(s) = \frac{Ks}{(1+s)^2}$. For the input $r(t) = 1 + 5t$ Find the minimum value of K so that the steady state error is less than 0.1 (7)

MODULE III

15. Consider the type 1 open loop system $G(s) = \frac{1}{s(s+2)}$.Design a suitable compensator to meet the following specifications.(i).Settling time less than or equal to 2 Sec (ii). Damping ratio is 0.707. (14)

OR

16. a) Explain the PID tuning using Ziegler-Nichols method. (4)

b) Draw the root locus plot for the system whose open loop transfer function is given by $G(s)H(s) = \frac{K}{S(S+4)(S^2+4S+13)}$. Find the marginal value of K which causes sustained oscillations and find the frequency of oscillations. (10)

MODULE IV

17. Sketch the bode plot for the following transfer function and determine the phase margin & gain margin. $G(s) = \frac{20}{s(1+3s)(1+4s)}$. Also comment on stability of the system. (14)

OR

18. Plot the polar plot for the following transfer function .Also find the Phase margin, Gain margin and comment on the system stability. (14)

$$G(s) = \frac{15}{(s+1)(s+3)(s+6)}$$

MODULE V

19. Design a lead compensator for a unity feedback system with open loop transfer function $G(S) = \frac{K}{S(S+1)(S+5)}$ to satisfy the following specifications (i) Kv > 50 (ii) Phase Margin is > 20. (14)

OR

20. For the system with $G(S)H(S) = \frac{40}{(S+4)(S^2+2S+1)}$,Obtain the gain margin on stability using Nyquist plot. (14)

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