



# INSTITUTE OF AERONAUTICAL ENGINEERING (Autonomous)

B.Tech IV Semester End Examinations (Regular), November – 2020

Regulation: IARE-R18

## CONTROL SYSTEMS

Time: 2 Hours

(ECE | EEE)

Max Marks: 70

Answer any Four Questions from Part A

Answer any Five Questions from Part B

### PART – A

1. Differentiate open loop and closed loop control systems with suitable examples. [5M]
2. Write the properties of signal flow graphs. [5M]
3. Using Routh's method find the stability of  $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16 = 0$ . [5M]
4. Give a short notes on various frequency domain specifications. [5M]
5. Obtain the state space model of a series RLC circuit. [5M]
6. Write the analogous quantities in force-voltage analogy and force - current analogy. [5M]
7. What is the basis for framing the rules of block diagram reduction technique? [5M]
8. Write the necessary conditions to have all the roots of characteristics equation to left half of s-plane? [5M]

### PART – B

9. Describe the effect of feedback on gain, stability, noise and sensitivity of a closed loop control system. [10M]
10. Determine the transfer function of RLC parallel circuit if the voltage across the capacitor is a output variable and input is current source  $i(s)$ . [10M]
11. Explain the effect of P, PI, PD and PID control on the performance of control system. [10M]
12. Discuss Mason's gain formula. Obtain the overall transfer function  $C/R$  from the signal flow graph shown in Figure 1. [10M]

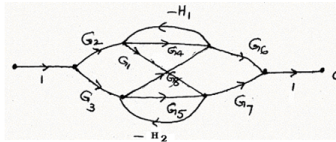


Figure 1

13. State the effect of addition of poles and zeros on root locus and the stability of the system. [10M]
14. Write a short notes on i) Absolute stability ii) Marginal stability iii) Conditional stability iv) Stable system v) Critically stable system vi) Conditionally stable system. [10M]
15. The characteristic equation for certain feedback control systems is given below  $s^4 + 4s^3 + 13s^2 + 36s + k = 0$ . Determine the range of  $k$  for the system to be stable. [10M]
16. Determine the expression for resonant peak and resonant frequency and hence establish correlation between time and frequency response. [10M]
17. Convert the following system matrix to canonical form and hence calculate the STM. [10M]

$$A = \begin{bmatrix} 4 & 1 & -2 \\ 1 & 0 & 2 \\ 1 & -1 & 3 \end{bmatrix}$$

18. Write the necessary and sufficient conditions for complete state controllability and observability? [10M]