R22

Code No: 185BF

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, January - 2025

CONTROL SYSTEMS

(Common to ECE, EIE)

Time: 3 Hours **Max. Marks: 60**

Note: This question paper contains two parts A and B.
i) Part- A for 10 marks, ii) Part - B for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of ten questions (numbered from 2 to 11) carrying 10 marks each. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a) Distinguish between continuous time feedback control system and discrete data feedback control system. [1]

b) Find the transfer function of the following circuit (figure 1), $\frac{V(s)}{I(s)}$. [1]

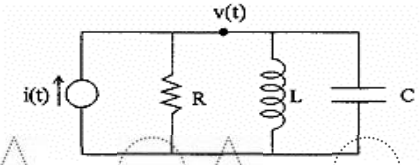

Figure 1

c) What do you mean by a Second order system? [1]

d) Examine the following characteristic equation for stability [1]

$$D(s) = s^4 + 2s^3 + s^2 + 4s + 2 = 0$$

e) What are Polar plots? [1]

f) What are all pass systems? [1]

g) What do you mean by a controller output range? [1]

h) Define the term offset. [1]

i) Define observability. [1]

j) What is eigen value? [1]

PART - B

(50 Marks)

2. Find the overall transfer function of the following system using block diagram reduction technique (figure 2). [10]

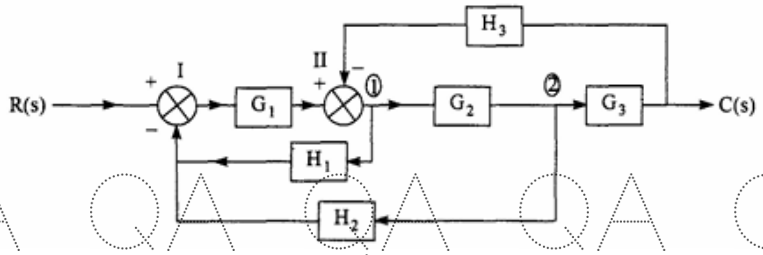

Figure 2

OR

3.a) Explain the mathematical modelling of a elements representing mechanical rotational systems.

b) Draw the signal flow graph for the network shown (figure 3) and obtain its transfer function. [5+5]

$$T(s) = \frac{I_2(s)}{V_1(s)}$$

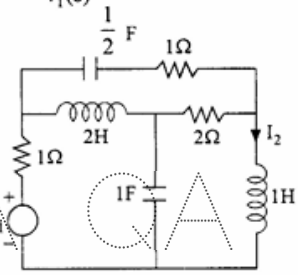

Figure 3

4.a) Explain about pole-zero form of representing the open loop transfer function.

b) Find the steady state error for unit step, unit ramp and unit acceleration inputs for the following system. [5+5]

$$\frac{1000(s+1)}{(s+10)(s+50)}$$

OR

5. Explain the response of a first order system for a (a) Unit step input (b) Unit ramp input and (c) Unit Parabolic input. [10]

6. Distinguish in detail between Time domain analysis and frequency domain analysis. [10]

OR

7. Obtain magnitude and phase angle Bode plots for the system: [10]

$$G(s) = \frac{20(0.1s+1)}{s^2(0.2s+1)(0.02s+1)}$$

8.a) List the various properties of a Controller.

b) Explain about the design of lead compensator in detail. [4+6]

OR

9.a) Explain about Integral control mode and give its characteristics.

b) Explain and realize the PID type of controller. [5+5]

10.a) In order to affect a complete controller design, a system must be controllable. Describe the physical meaning of controllability.

b) Obtain the phase variable state model for the system. [4+6]

$$\dddot{y} + 2\ddot{y} + 3\dot{y} + y = u$$

OR

11.a) List and explain the properties of State transition matrix.

b) Find the homogenous solution of the system. [4+6]

$$\dot{X} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} X; \qquad X_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

---ooOoo---