Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 17 – 12- 2025 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B. Tech	
Course Code: ECE3006	**Course Name:** Digital Control Systems	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	14	14	17	17	19	19

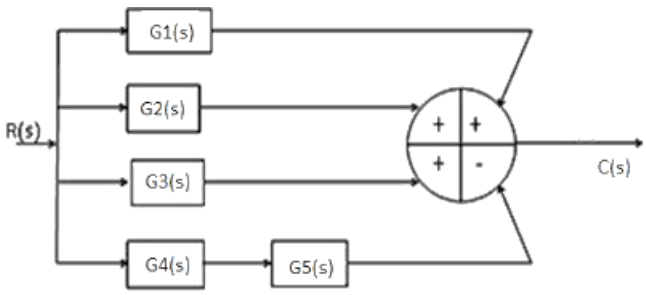
Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

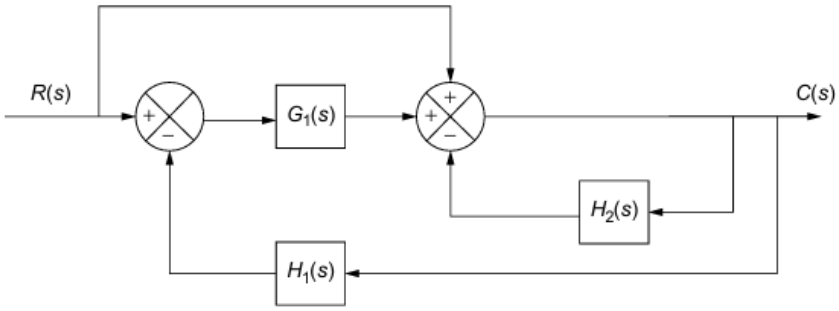
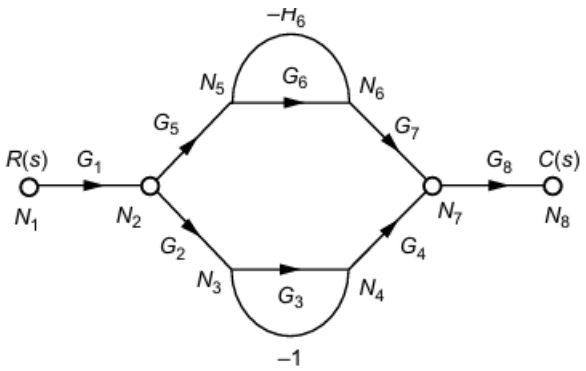
Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	State Mason's Gain Formula used in Signal Flow Graph analysis.	**2 Marks**		**CO1**
2.	Write down the transfer function of the system whose block diagram is shown below. 	**2 Marks**	**L2**	**CO1**
3.	How is the sampling period Tinvolved in the bilinear transform? Write the formula including T.	**2 Marks**	**L2**	**CO2**
4.	Given the continuous-time transfer function $G(s) = \frac{1}{s+2}$ locate its pole on the s-plane and comment on the stability of the analog system.	**2 Marks**	**L2**	**CO2**

5.	Distinguish between steady state response and transient response.	**2 Marks**	**L2**	**CO3**
6.	Define delay time in the context of time-domain specifications of a control system.	**2 Marks**	**L2**	**CO4**
7.	What are asymptotes? How will you find the angle of asymptotes?	**2 Marks**	**L2**	**CO5**
8.	Differentiate between the Routh–Hurwitz stability criterion and the Root Locus method.	**2 Marks**	**L2**	**CO5**
9.	Find the state space form of $2\frac{d^3c(t)}{dt^3} + 4\frac{d^2c(t)}{dt^2} - 6c(t) = 8r(t)$	**2 Marks**	**L2**	**CO6**
10.	What is controllability? State its significance in state-space analysis.	**2 Marks**	**L2**	**CO6**

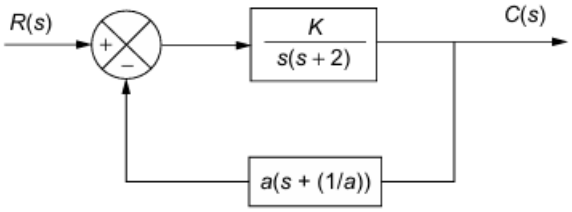
Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Determine the transfer function using block diagram reduction technique. 	**10 Marks**	**L3**	**CO1**
		Or			
12.	**a.**	The signal flow diagram for a particular system is shown in Fig., Determine the transfer function of the system using Mason's gain formula. 	**10 Marks**	**L3**	**CO1**

13.	**a.**	Using Bilinear transformation, find the transfer function of the digital filter for $$\mathbf{H(s) = \frac{6}{(S+2)(2S+3)}}$$	**10 Marks**	**L3**	**CO2**

		Or			
14.	**a.**	Using Bilinear transformation, find the transfer function of the digital filter for $H(s) = \frac{3}{(S^2+6S+9)}$ for T=1Sec.	**10 Marks**	**L3**	**CO2**

15.	**a.**	Obtain the response of unity feedback system whose open loop transfer function is $\mathbf{G(s) = \frac{6}{s(s+7)}}$ and when the input is unit step	**15 Marks**	**L3**	**CO3**
		Or			
16.	**a.**	The system shown in Figure has a damping ratio of 0.7 and an undamped natural frequency of 4 rad/sec. Determine the gain 'K' and constant 'a'. 	**15 Marks**	**L3**	**CO3**

17.	**a.**	The differential equation for a system is given by $$\mathbf{\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 16y(t) = 9x(t)}$$ Determine (i) the time-domain specifications such as settling time, peak time, delay time, rise time and % peak overshoot and (ii) output response of the system subjected to a unit-step input (iii) Examine the influence of damping ratio and natural frequency on time domain specifications of control system	**15 Marks**	**L4**	**CO4**
		Or			
18.	**a.**	A unity feedback system has an open-loop transfer function $G(s) = \frac{K}{s(s+10)}$. Determine the gain K so that the system has a damping ratio of 0.5. Also, determine (i) settling time t_s, (ii) peak overshoot M_p and (iii) peak time t_p subjected to a unit-step input. (iv) Examine the influence of damping ratio and natural frequency on time domain specifications of control system.	**15 Marks**	**L4**	**CO4**

19.	**a.**	Sketch the root locus of the system whose open loop transfer function with unity feed back $$\mathbf{G(s) = \frac{K(s+1.5)}{s(s+1)(s+5)}}$$ Examine the stability analysis for both Routh Hurwitz and root locus method	**15 Marks**	**L4**	**CO5**
		Or			
20.	**a.**	Sketch bode plot for the following transfer function and determine the system gain and phase cross over frequency. $$G(s) = \frac{20}{s(1+3s)(1+4s)}$$ Examine the stability analysis for both Routh Hurwitz and Bode plot method	**15 Marks**	**L4**	**CO5**

21.	**a.**	Check whether the system given below is controllable and observable. $$\dot{\mathbf{X}} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}\mathbf{X} + \begin{bmatrix} -1 \\ 2 \end{bmatrix}\mathbf{U}$$ $$\mathbf{Y} = [2 \quad -1]\mathbf{X}$$	**15 Marks**	**L3**	**CO6**
		Or			
22.	**a.**	**Find the transfer function of the state space model** $$\dot{\mathbf{X}} = \begin{bmatrix} -1 & 2 \\ -4 & -2 \end{bmatrix}\mathbf{X} + \begin{bmatrix} -1 \\ 2 \end{bmatrix}\mathbf{U}$$ $$\mathbf{Y} = [1 \quad -1]\mathbf{X}$$	**15 Marks**	**L3**	**CO6**