Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

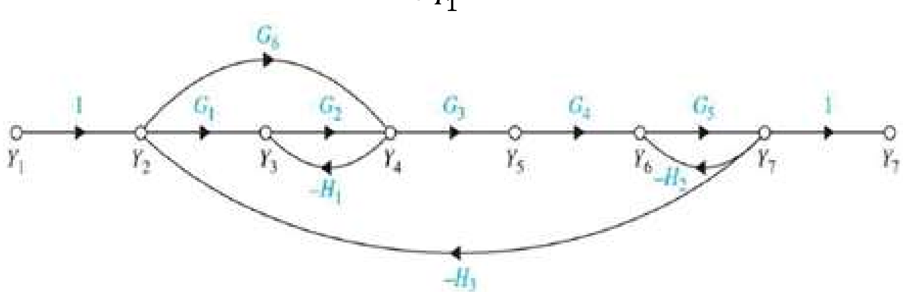
End Semester Examination, December 2023

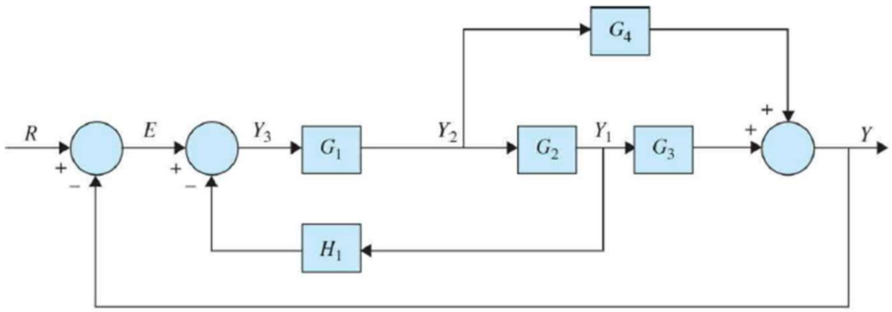
Course: Control Engineering — **Semester: VII**

Program: BTech ADE — **Time: 03 hrs.**

Course Code: MECH 4034P — **Max. Marks: 100**

Instructions: Attempt all questions.

	SECTION A **(5Qx4M=20Marks)**		
S. No.		**Marks**	**CO**
Q 1	Determine the poles and zeros of the given transfer function. Also comment on the stability of the system. $$G(s) = \frac{(s+3)(s+8)}{(s+5)(s-4)(s-2)}$$	**4**	**CO3**
Q 2	Define the closed loop control system by an example.	**4**	**CO1**
Q 3	Define the steady state error in the system for the unity feedback control system.	**4**	**CO1**
Q 4	Explain the time response parameters of any feedback control system.	**4**	**CO2**
Q 5	Using the Routh-Hurwitz criterion, determine the stability of the system that has the following characteristic equations. $$s^3 + 25\, s^2 + 10\, s + 450 = 0$$	**4**	**CO3**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Apply the Mason's gain rule to signal flow graph as shown in figure, to determine the transfer function Y_7/Y_1. 	**10**	**CO2**

Q 7	Determine the time response of the given system model for unit step input and comment on the stability of the system. $$\ddot{y}(t) + 8\dot{y}(t) + 16y(t) = u(t)$$	**10**	**CO2**
Q 8	Determine the input-output transfer function (*Y/R*) of the system by reduce the block diagram. 	**10**	**CO2**
Q 9	Given the forward-path transfer function of unity-feedback control systems, apply the Routh-Hurwitz criterion to determine the stability of the closed-loop system as a function of *K*. $$G(s) = \frac{K(s+4)(s+20)}{s^3(s+100)(s+500)}$$ **Or,** Determine the range of feedback gains so that closed loop system will be stable. The transfer function of the system is given as $$G(s) = \frac{(s-5)}{(s^2+s+1)(S+10)}$$	**10**	**CO3**
SECTION-C (2Qx20M=40 Marks)			
Q 10	A unity-feedback control system has the forward-path transfer functions given in the following. Construct the complete root-locus diagram for $0 \le K \le \infty$. Find the values of *K* at all the breakaway points. $$G(s) = \frac{K(s+3)}{s(s^2+4s+4)(s+5)(s+6)}$$ **Or,**	**20**	**CO3**

	The feedforward transfer function of a unity-feedback system is $$G(s) = \frac{K(s+2)^2}{(s^2+4)(s+5)^2}$$ a) Construct the root loci for $K = 25$. b) Find the range of K value for which the system is stable.		
Q 11	Draw the Nyquist plot and determine the range of stable gains for the given forward-path transfer function of the system. $$G(s) = \frac{(s+5)}{(s+2)(s^2+2s+2)}$$	**20**	**CO4**