Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Sixth Semester - Regular) Examinations, April 2026

23BECPC36003 - Control Systems

Electronics and Communication Engineering

Time: 3 hrs Maximum: 60 Marks

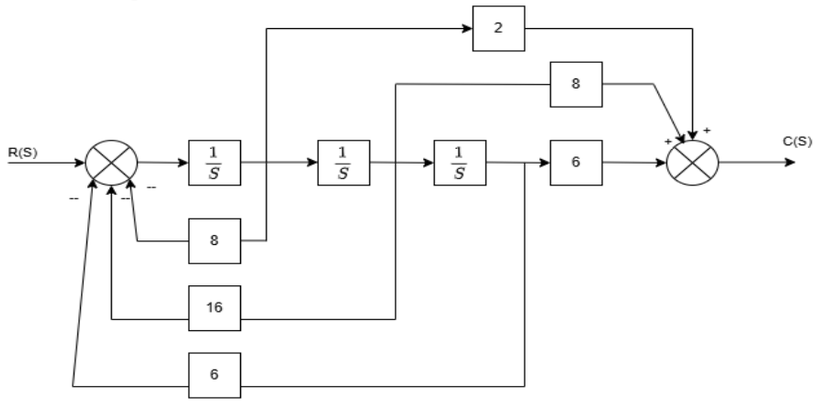
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

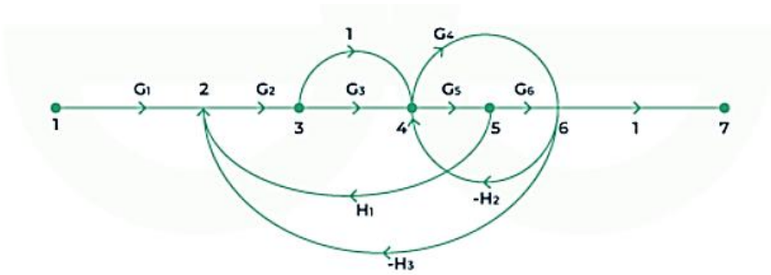
	Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a.	If the system transfer function is $\frac{Y(S)}{X(S)} = \frac{s+4}{s^2+2s+5}$, obtain the differential equation representing the system.	CO2	K3
b.	What is meant by real time implementation of PID type controller?	CO5	K2
c.	Represent the state space in its state equations as well as matrix from.	CO6	K2
d.	Differentiate between open loop and close loop system.	CO1	K2
e.	Define a Breakaway point in root locus.	CO4	K1

PART – B **(10 x 5 = 50 Marks)**

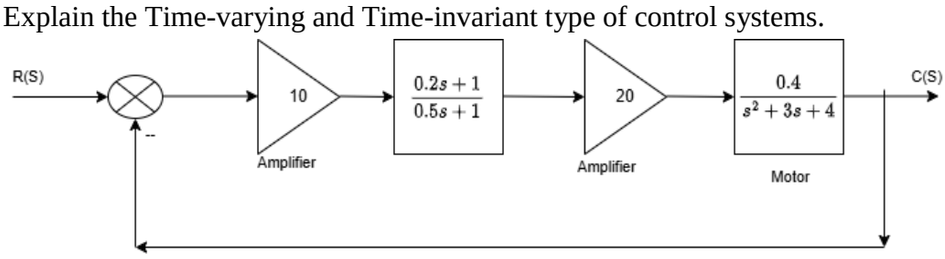
	Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a.	Determine the transfer function of the system given using block diagram reduction technique	6	CO2	K3



b.	Differentiate between block diagram reduction techniques and signal flow graph to find the transfer function of the system.	4	CO2	K2
	(OR)			
c.	For the system given with 7 number of nodes, determine the transfer function using Mason's Gain Formula.	6	CO2	K3

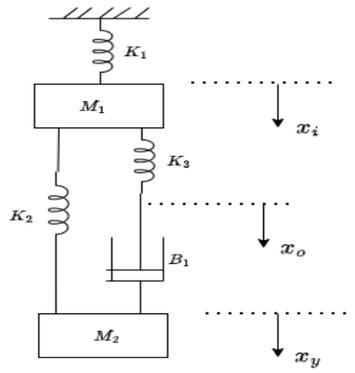
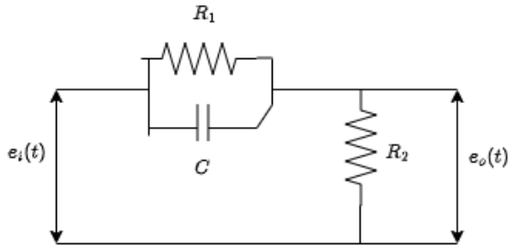
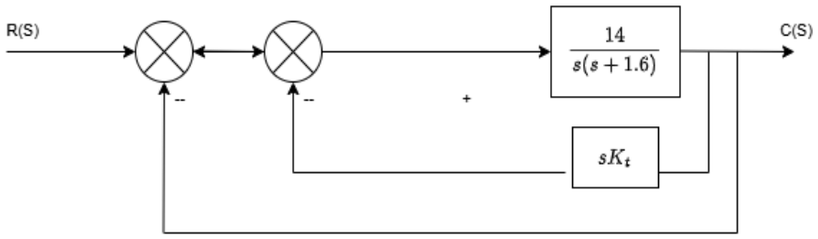


d.	Explain the Time-varying and Time-invariant type of control systems.	4	CO1	K2
3.a.		5	CO3	K3



For the system shown in the figure, find the type of the system, all error coefficients and steady state error for (i) unit step input (ii) unit step velocity input (iii) unit step acceleration input

b.	A system is given by the differential equation, $\frac{d^2y}{d^2t} + 4\frac{dy}{dt} + 8y = 8x$, where y is output and x is input. Determine all time domain specifications and find the expression of output response for unit step input.	5	CO3	K3
	(OR)			

c.	The open loop transfer function of a unity feedback control system is given by G(S)= $\frac{K}{s(sT+1)}$. By what factor the time constant T should be multiplied so that the damping ratio is reduced from 0.6 to 0.3.	5	CO3	K3
d.	A system has the following transfer function: $\frac{C(S)}{R(S)} = \frac{20}{s+10}$. Determine its unit impulse, step and ramp response with zero initial conditions. Sketch the responses.	5	CO3	K3
4.a.	Sketch the Nyquist plot and determine stability where the open loop transfer function with unity feedback is given as G(S)H(S) = $\frac{10}{s^2(s+2)}$.	5	CO4	K3
b.	The state equations are given as, $\dot{x_1} = x_2 + x_3 + u$, $\dot{x_2} = x_1 + 2x_2 + 3x_3 + u$, $\dot{x_3} = 3x_1 + 2x_2 + x_3 + 2u$ and y = $x_1 + 2x_2 + x_3$. Find the transfer function of the system.	5	CO6	K3
	(OR)			
c.	The transfer function of a system is given as $\frac{Y(S)}{U(S)} = \frac{5}{S^3+5S^2+9S+5}$. Represent the transfer in matrix form and draw the state diagram.	5	CO6	K3
d.	Write short notes on Proportional-Integral-Derivative (PID) type controller	5	CO5	K2
5.a.	Use Routh-Hurwitz criterion and determine (i) Number of roots on left half of s-plane (ii) Number of roots on right half of s-plane (iii) Number of roots on imaginary axis. The characteristics equation is $s^4 + 2s^2 + 1 = 0$.	5	CO4	K3
b.	The open loop transfer function of a unity feedback system is given as, G(S)=$\frac{k\,(s+0.5)}{s(s^2+2s+2)}$. Draw the root locus for the system and determine the stability. Comment on the range of K for stability.	5	CO4	K4
	(OR)			
c.	Draw the mathematical model and represent the system equations for the mechanical system shown below 	5	CO2	K3
d.	Obtain the transfer function of the network shown aside. 	5	CO2	K3
6.a.	The system shown in the figure uses a rate feedback controller. Determine the constant K_t to obtain the damping ratio as 0.5. Calculate corresponding T_p, μ_p, ω_d, and T_s. 	5	CO5	K3
b.	Derive the equation of N-circle.	5	CO4	K3
	(OR)			
c.	Derive the expression for unit step response of a second order system.	5	CO3	K3
d.	The open loop transfer function with unity feedback is given as G(S)H(S) = $\frac{1}{(1+T_1S)(1+T_2S)}$. Obtain its polar plot.	5	CO4	K3

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