QP Code: RA23BTECH180 | Reg. No | | | | | | | | | | | AY 23

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

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

23BCHPC36002 – Process Control

(Chemical Engineering)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

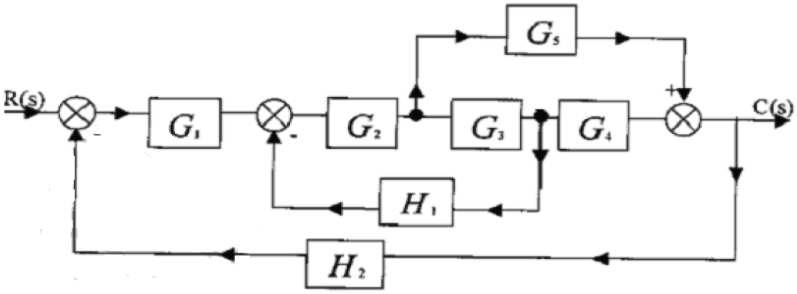
PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Define Forcing Function. What are different types of forcing function generally used in process control.	CO1	K1
b.	State the general form of transfer function of a second order instrument or process.	CO1	K1
c.	Distinguish between response and transient response?	CO3	K2
d.	Mention the general form of transfer function of a PI and PID controller?	CO2	K1
e.	Define Bode plot , Offset and Sampling Period.	CO5	K1

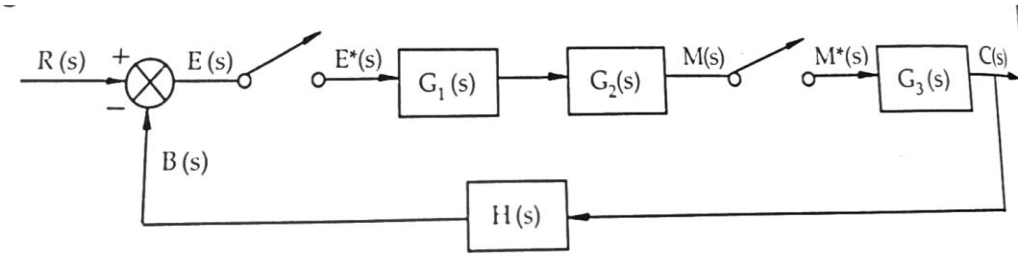
PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	In a process consist of non- interacting two tank multi capacity control system in series. The inflow 'q_1' would be considered as the variable to be controlled. Inflows q_1& q_2 considered as load variables. Downstream head at the lower tank is considered constant, 'h_1' is the head in the upper tank & 'q_r & q_o' are the outflows at the upper & the lower tanks respectively. Assume the flow resistance to be linear. Determine the operational equation for the overall system relating q, q_1, q_2 & q_o with the time constant τ_1 & τ_2 of the respective tank. Assuming that the inflows q_1 & q_2 are turned off and allowing a unit step change in the flow rate q. Determine the process response equation.	10	CO1	K4
	(OR)			
b.	Discuss the characteristic of first order system for the step forcing function in the input variable of the system	5	CO1	K2
c.	Derive transfer function of Mercury Thermometer.	5	CO1	K3
3.a.	The transfer function of a control system is given as G(s)= $\frac{Kc(0.5s+1}{s(s+1)(s+0.5)}$. Determine the Value of Kc of the controller which just causes instability. Use the Routh Criteria and determine the location of the pair of roots lie on the imaginary axis of the control system	10	CO2	K4
	(OR)			
b.	A thermometer is given the impulse change of magnitude as 10. The time constant of the thermometer is 6 sec. Sketch the response of the thermometer assuming that it is first order system.	10	CO2	K3

4.a.	A PD-Controller is used for the control of 1st order system having time constant τ1=30sec. The value of gain of controller is Kc =6 and derivative time τd=4sec. the Control system has a measuring element for which the time constant τ2=6sec. If a step change of magnitude 0.16 is given to load variable. Determine Offset. Also determine maximum value of the response.	10	CO3	K4
	(OR)			
b.	Determine the overall transfer function C/R for the following system	10	CO3	K3



5.a.	Sketch the root locus diagram for the system having open loop transfer function. G(s) = $\frac{k_c(s+6)}{s(s+2)(s+4)}$. Determine the value of K_c for which system becomes just unstable	10	CO4	K4
	(OR)			
b.	Differentiate between cascade and adaptive control.	5	CO4	K2
c.	Write the guidelines for controller tuning.	5	CO5	K2
6.a.	Determine the Z-transform equation for the discrete time control system for the following figure:	10	CO6	K3



(OR)

b.	The open loop transfer function of a feedback discrete time control system is GH(s) = $\frac{k(1-e^{-Ts})}{s(s+2)(s+4)}$. Taking sampling period T = 1sec. Determine the value of K for which the system is just unstable.	10	CO6	K4

--- End of Paper ---