CBCS SCHEME

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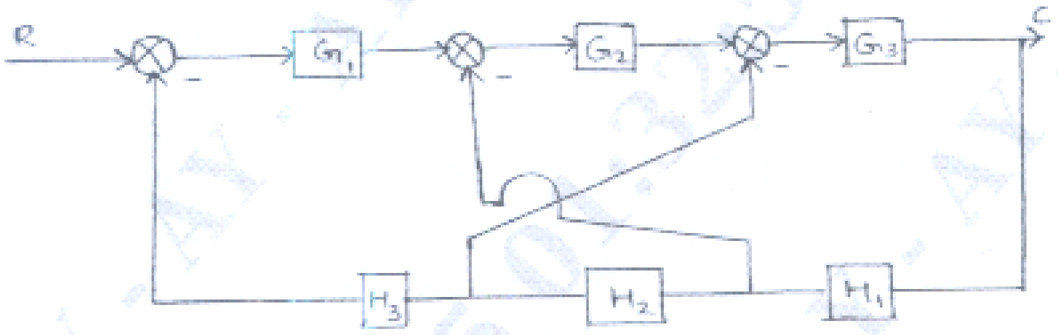
BBT601

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Bioprocess Control and Automation + Lab

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	a.	Explain with a neat sketch the principles and operations of level and flow measuring instruments.	10	L2	CO1
	b.	Explain the various physio-chemical and biological parameters which are measured and controlled in a bioreactor.	10	L2	CO1
		OR			
Q.2	a.	With a neat sketch, explain flow injection analysis.	10	L2	CO1
	b.	With a neat sketch, explain principles and operations of temp measuring instruments.	10	L2	CO1
		Module – 2			
Q.3	a.	Derive the transfer function of first order system for a mercury thermometer.	10	L2	CO1
	b.	A thermometer having first order dynamics is placed in a temperature bath at 40°C. After thermometer reaches a steady state, it is suddenly placed in a temperature bath at 50°C at $t = 0$ and left there for 1 min and removed immediately to the temperature bath at 40°C. Draw the sketch showing the variations of thermometer reading with time. Also calculate the thermometer reading at time $t = 0.5$ min and $t = 2$ min.	10	L2	CO1
		OR			
Q.4	a.	Derive the linear response equation for a I order system.	10	L2	CO1
	b.	What are the different forcing function used in control system with their Laplace transform.	10	L2	CO1
		Module – 3			
Q.5	a.	Derive the transfer function for the IInd order system for a spring damper.	10	L3	CO2
	b.	What is Transportation Lag? Derive transfer functions for transportation lag.	10	L3	CO2

		OR			
Q.6	**a.**	A step change of magnitude 4 is introduced into the system having the transfer function. $\frac{y(s)}{x(s)} = \frac{4}{s^2 + 1.6s + 4}$ Determine : i) Overshoot ii) Rise time iii) Response time iv) Period of oscillation v) $Y_{altimath}$ vi) Y_{max}	**10**	**L3**	**CO2**
	b.	Derive the transfer function for 2 tank non-interacting system.	**10**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Write the equations relating the output and error signal for the following control modes: i) PD controller ii) PID controller.	**10**	**L3**	**CO3**
	b.	A step change of magnitude 4 is introduced into a PI controller. The value of gain is 6 and reset rate is 0.5 plot the response of the PI controller.	**10**	**L3**	**CO3**
		OR			
Q.8	**a.**	Determine the overall transfer function $\frac{C(S)}{R(S)}$ for the Fig.Q.8(a) given below:  Fig.Q.8(a)	**10**	**L3**	**CO3**
	b.	Derive the offset equation for proportional controller for regulatory control mechanism.	**10**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Define stable and unstable system and give the examples for the same. What is the characteristic equation for control system?	**10**	**L2**	**CO4**
	b.	Discuss the Routh Hurwitz test for stability. And theorems on Routh test. Also explain the merits and demerits of the same.	**10**	**L2**	**CO4**
		OR			
Q.10	**a.**	Determine the stability of control system whose characteristic equation is $s^6 + 4s^5 + 3s^4 + 2s^3 + s^2 - 4s + 4$	**5**	**L3**	**CO4**
	b.	Outline the rules for plotting the root locus diagram.	**10**	**L2**	**CO4**
	c.	Infer a note on bode plot.	**5**	**L2**	**CO4**