

CBCS SCHEME

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BBT601

Sixth Semester B.E./B.Tech. Degree Examination, June/July 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.*

Module – 1			M	L	C
Q.1	a.	Explain in detail about the online and offline biomass estimation.	10	L2	CO1
	b.	With a neat diagram, explain the working principle of venturimeter and thermocouples.	10	L2	CO1
OR					
Q.2	a.	Explain briefly the physical, chemical and biological parameters which are measured and controlled in a bioreactor.	10	L2	CO1
	b.	With a neat sketch, explain the working of Bourdan tube and Thermistor.	10	L2	CO1
Module – 2					
Q.3	a.	Derive the step response for the mercury thermometer.	12	L3	CO2
	b.	A thermometer having first order dynamics is placed in a temperature bath of 45°C. After the thermometer searches the equilibrium with the bath, the bath temperature is subjected to sinusoidal forcing function about its average temperature of 45°C with an amplitude of 15°C. If the period of oscillation is 3 sec/cycle and time constant of thermometer is 10 second. Determine : i) Amplitude ratio ii) Maximum and minimum temperature indicated by thermometer.	8	L3	CO2
OR					
Q.4	a.	Derive the transfer function for the liquid level system with constant flow outlet.	10	L3	CO2
	b.	A thermometer having a time constant of 10 s is placed in a water bath. After the thermometer reaches steady state temperature of 30°C it is suddenly placed into a hot fluid of 60°C. Determine the response of thermometer at : i) 10°C ii) 30°C.	10	L3	CO2

Module – 3

Q.5	a.	Obtain $\frac{H_2(s)}{Q_0(s)}$ for two tank non-interacting system.	10	L2	CO2
	b.	Explain the characteristics of an underdamped second order system for step forcing function.	10	L3	CO2
OR					
Q.6	a.	If the overall transfer function of the control system is given as : $G(s) = \frac{10}{1.25s^2 + 2s + 15}$ And a step change of magnitude 5 is introduced into the system. Find : i) Response time ii) Rise time.	10	L3	CO3
	b.	Obtain the transfer function damped vibrator.	10	L3	CO3

Module – 4

Q.7	a.	Obtain the transfer function $C(s)/R(s)$ for the block diagram shown in Fig.Q7(a).	10	L3	CO4
		Fig.Q7(a)			
	b.	Obtain the transfer function for : i) PD Controller ii) PID controller.	10	L3	CO4

OR

Q.8	a.	Determine the offset for the propositional controller for servo-mechanism control system which is of first order with step input.	10	L3	CO4
	b.	Determine the overall transfer function $C(s)/R(s)$ for the system shown in Fig.Q8(b).	10	L3	CO4

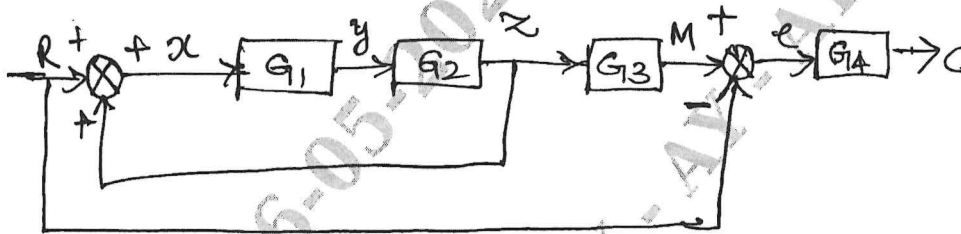
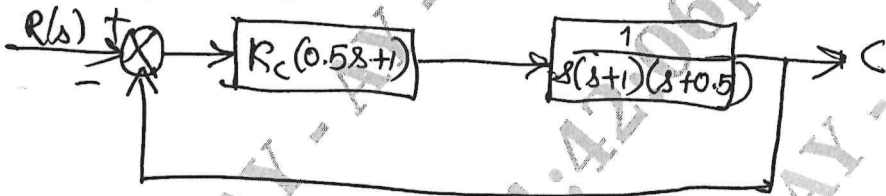


Fig.Q8(b)

Module – 5

Q.9	a.	A control system is represented as follow.  Determine the value of K_C for the controller which just causes instability use Routh criterion. Also determine the location of the pair of roots lie on the imaginary axis for the control system.	10	L4	CO4
	b.	Interpret on bode stability criterion and also on phase, gain margin	10	L4	CO4

OR

Q.10	a.	The open loop transfer function of a control system is given as $G(s) = \frac{K_C(0.5s+1)}{s(s+1)(s+0.5)}$ Sketch the root locus diagram of the control system. Indicate open loop poles, zero, break away point, asymptotic lines, direction in which the loci travel. Determine the value of gain of the controller K_C for which the system becomes just unstable.	12	L4	CO4
	b.	Interpret on Routh – Hurwitz stability criterion.	8	L4	CO4
