MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL A Constituent Institution of Manipal University

VII SEMESTER B.TECH. EXTERNAL EXAMINATIONS NOVEMBER 2018 SUBJECT: BIOPROCESS CONTROL [BIO 4102]

Date of Exam: 24/11/2018 Time of Exam: 2.00 PM – 5.00 PM Max. Marks: 50

Instructions to Candidates:

✤ Answer ALL the questions & missing data may be suitable assumed

1A.	Why a control system is important for the biological processes?	3
1B.	How degrees of freedom evaluation helps in modelling and design of a control system?	3
1C.	Find y(t) by solving $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 4$; y(0) = 2; y'(0) = 3.	4
2A.	Determine the dynamic response of a first order system ($\tau_P = 0.2 \min \& K_p = 4$) to an input change by i) unit step ii) unit impulse.	4
2B.	A thermometer showing steady state temperature of 30°C is suddenly immersed into a hot water bath at 150°C which follows first order dynamics ($\tau_P = 0.8 \ sec \ \& K_p = 2$). Determine the following i) Thermometer reading after 12 sec ii) Time required to read 50°C on Thermometer iii) Time required for 80% of the response.	6
3A.	A second order system as transfer function of $G_p(s) = \frac{1}{(s+1)(s+4)}$. Determine:	5
3B.	If a closed loop response is stable with respect to changes in the set point, is it stable to changes in the load? If yes, why?	5
4A.	Check for stability by using Routh Hurwitz method. $s^{6} + 2s^{5} + 8s^{4} + 12s^{3} + 20s^{2} + 10s + 16 = 0$	3
4B.	$X(s) \xrightarrow{+} G_1 \xrightarrow{+} G_2 \xrightarrow{+} G_3 \xrightarrow{+} G_4 \xrightarrow{+} Y(s)$	7
	Determine the closed loop transfer function for block diagram shown above.	
5A.	plots.	5
5B.	Discuss the rationale of a cascade control system and demonstrate why it provides better response than simple feedback.	5