MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. EXTERNAL EXAMINATIONS NOVEMBER 2017

END SEMESTER EXAM

SUBJECT: BIOPROCESS CONTROL [BIO 4102]

Date of Exam: **21/11/2017** 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.	What are the operational objectives that a control system is called upon to achieve?	**3**
1B.	Why do you need to develop the mathematical model of a process you want to control?	**3**
1C.	Can you have the desired operation for an underspecified process? If yes, explain why. If no, explain how can you lift the under specification.	**4**
2A.	Using Laplace Transform solve $\frac{d^2y}{dt^2} + y = 2e^t$; given that $y(0) = 1;\ y'(0) = 2$.	**7**
2B.	Does location of the zeros of a system affect its response to external inputs? Justify the answer.	**3**
3A.	Consider the general closed-loop block diagram with $G_c(s) = 1.2$, $G_p(s) = \frac{10}{(s+1)(2s+1)}$ Suppose that the system is subject to a set point change in the input of magnitude 0.1. Determine maximum value of the response and the offset.	**4**
3B.	A thermometer showing a steady state temperature of 30°C is suddenly immersed into a hot water bath at 120°C which follows first order dynamics with time constant of 7 seconds. Determine the following i) Thermometer reading after 7 sec ii) Time required to read 50°C on Thermometer iii) Time required for the 90% response.	**6**
4A.	What is the relative advantages and disadvantages of the three time integral criteria, ISE, IAE, and ITAE? How would you select the most appropriate for a particular application?	**4**
4B.	Consider the general closed-loop block diagram with $G_c = K_c$, $G_m = G_f = 1$ and $G_p = 1/(s+3)^3$. Find the value of K_c for which the system is on the verge of instability. The controller is then replaced by a PD controller, if $K_c = 10$, determine the range of derivative time for which the system is stable.	**6**
5A.	Sketch BODE Plot for the transfer function $G(s) = \frac{5}{(s+1)(2s+1)(3s+1)}$.	**6**
5B.	Are the stability characteristics of the closed loop response of a cascade system better than those of a simple feedback? Elaborate on your answer**.**	**4**