मोतीलाल नेहरू नेशनल इंस्टिट्यूट ऑफ़ टेक्नोलॉजी इलाहाबाद
प्रयागराज-211004 [इंडिया]

Motilal Nehru National Institute of Technology Allahabad
Prayagraj-211004 [India]

End Semester Examination 2020-21

Programme Name: B.Tech **Semester:** V
Course Code: CH15103 **Course Name: Process Dynamics and Control**

Branch: Chemical **Student Reg. No.:** | | | | | | | | |

Duration: 2 Hours **Max. Marks: 40**

Instructions:

1. *Answer the questions sequentially; 2. Use of non-programmable scientific calculator is permitted.*

			Marks
		Part A	
Q 1		Consider a feedback control system that has the open-loop transfer function, $$G(s) = \frac{2\,Kc\,(1+0.5s)e^{-2s}}{(s+2)(2s+1)}$$ Find the values of controller gain K_c that make the feedback control system stable.	8
Q 2		For a PI controller with a controller gain of 5 and integral time 15, determine (a) Transfer function (b) Amplitude Ratio (AR) and Phase Angle (ø).	8
		Part B	
Q 3		A chemical process is represented by the following equation: $$\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 6y = 3$$ (a) Solve the above equation assuming $y(0) = y'(0) = y''(0) = 0$ and find out the expression depicting the output y as a function of time i.e. y(t). (b) Using final value theorem, determine $y(\infty)$.	12
Q 4		A PID controller having an integral time equal to 10 and derivative time (τ_D) equal to 0.5 is used to control two non-interacting first order systems having time constants of 1 and 2. The gain of the system is 4 and time delay is 2. Draw an appropriate block diagram for this process and determine the stability of the control system using Routh criteria. (Note: assume $G_v = 1/s$ and $G_m = 1$)	12