Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (CHEMICAL ENGINEERING)

MAKE UP EXAMINATIONS, JULY 2016

SUBJECT: PROCESS DYNAMICS AND CONTROL [CHE 308]

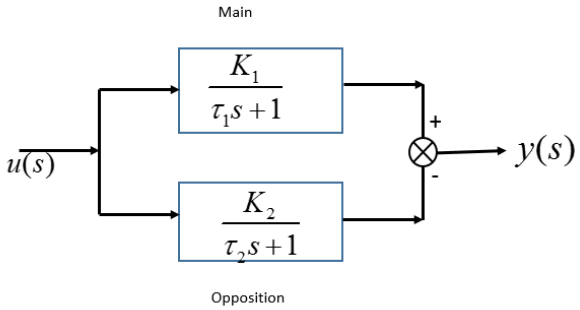
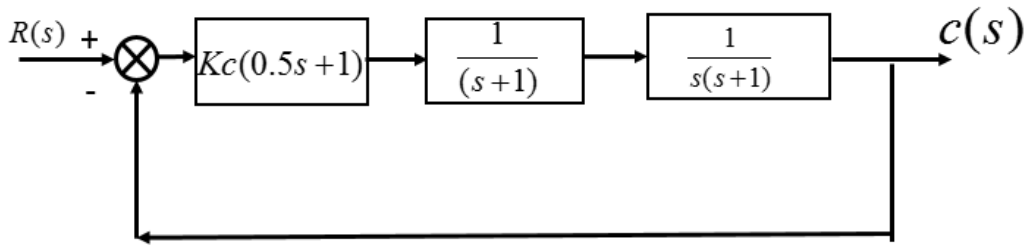
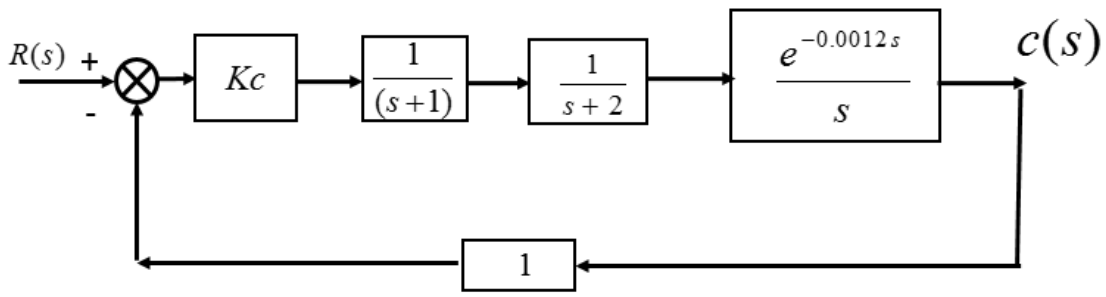
REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.

1A	What differentiates a feedback control system configuration from the feedforward configuration?	06
1B	Discuss cascade controller and adaptive controller schemes.	06
1C	Develop a transfer function model relating exit concentration and inlet concentration in a CSTR, in which first order reaction is undergoing. Write down all the assumption which you make.	08
2A	Solve the differential equation using Laplace transform . $y^{111}+2y^{11}-y^{1}-2y=0, \text{Given} \quad y(0)=y^{1}(0)=0; y^{11}(0)=6$	10
2B	Distinguish between bounded and unbounded forcing function? Give their mathematical relationship with figure and its Laplace transform	10
3A	Explain the characteristics of time delay system. Specify the transfer function model of time delay system and approximate with Pade's approximation.	06
3B	Sketch the response of pure time delay system for various inputs like Step, Rectangular pulse, Impulse and Ramp.	04
3C	A thermometer assumed to first order dynamics with a time constant of 1 min is placed in a temperature bath at 100 ^{0}C. After the thermometer reaches steady state, it is suddenly placed in a bath at 110^{o}C at t = 0 and left there for 1 min, after which it is immediately returned to the bath at 100 ^{o}C. Calculate the thermometer reading at t = 0.5 min and at t = 2.0 min.	10
4A	A proportional controller is used to control two liquid level systems connected in a non-interacting way. The time constant for tanks are 1 and 0.5. The value of the controller gain is 5. Assume that unity feedback control system. A step of magnitude 0.7 in set-point is introduced. Assume that gain of the plant is unity. Determine the offset.	10

4B	Let us consider in particular the situation where we have a system composed of two opposing first-order modes (see figure below). We consider the "main" steady-state gain K_1 to be larger than the "opposition" steady-state gain K_2. (a) Investigate the qualitative nature of this system's unit step response for: (i) Both steady-state gains are positive (ii) Both steady state gains are negative (b) Give some physical example for this kind of system 	10
5A	Sketch the root locus of the control system shown below.  Determine the value of gain of the controller for which the system is on the verge of unstable.	12
5B	Prove that G(s) = G(jw) for frequency response analysis.	08
6A	Which of the classical controllers, P, PI, PD, and PID, usually gives rise to transient responses with nonzero offset when used in a feedback loop?	06
6B	Determine the ultimate gain and ultimate period using frequency response method for the control system shown in Figure below. 	14