Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY 2017

SUBJECT: PROCESS DYNAMICS AND CONTROL [CHE308]

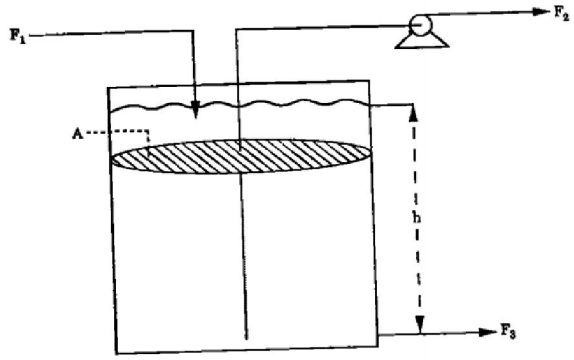
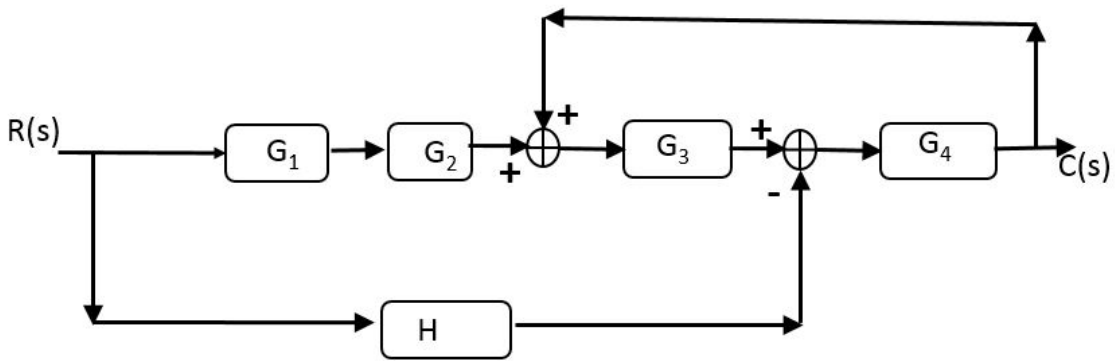
REVISED CREDIT SYSTEM

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.	How can you distinguish a manipulated variable from a disturbance variable?	**04**
1C.	Differentiate between a servo control problem and a regulatory control problem. Can you guess which will be more common in a plant in which the processes operate predominantly in the neighborhood of steady-state conditions for long periods of time	**10**
2A.	Explain the process of linearization. Water flows over a notch and its flow-head relationship is established as $Q = H^n$ [where n = 2.22]. Find the linearized resistance for flow	**10**
2B.	Solve the differential equation using Laplace transform $\frac{dx}{dt} + 3x = 0 \quad \text{given} \quad x(0) = 2$	**10**
3A	Prove the Final value theorem of Laplace transform.	**08**
3B.	This Figure 3B is from a Department of Energy underground storage tank. Such tanks are used throughout the India for storing gasoline for sale to the public. Recently, engineers believe that a leak has developed, which threatens the Environment. Your supervisor has assigned you the task of modeling the height in the tank as a function of the supply flow F1 , the sales flow F2, and the unmeasured leakage F3· It is assumed that this leakage is proportional to the height of liquid in the tank (i.e., F3 = kh). The tank is a cylinder with constant cross-sectional area A. The specific gravity of the gasoline is 0.78 and is assumed to be constant. Find the transfer function model for the level in the tank as a function of the supply flow and the sales flow. Which of these input variables would you describe as a control variable and which would you describe as a disturbance variable?	**12**

	 Figure 3B.	
4A.	If chemical processes are almost universally nonlinear in nature, so that their mathematical models are almost always nonlinear, why are linear approximations found to be adequate in a substantial number of cases, especially when feedback control is involved?	**06**
4B.	Whar are the poles and zeros of transfer function?	**06**
4C	What is the process reaction curve, and how is it used for feedback controller tuning?	**08**
5A.	Obtain the closed loop transfer function for the system shown below: 	**08**
5B.	Obtain the closed loop transfer function for servo and disturbance rejection regulatory problem (*Consider the closed loop system has transfer model of process, controller, final control element , measuring element and disturbance*)	**12**
6A.	The open loop transfer function of 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.	**12**
6B.	Discuss the working principle of ratio control and auctioneering control scheme.	**08**

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