


VIT

Vellore Institute of Technology

Final Assessment Test – May 2024

Course: BCHE305L - Process Dynamics and Control

Class NBR(s): 1269 / 1278

Time: Three Hours

Slot: B1+TB1

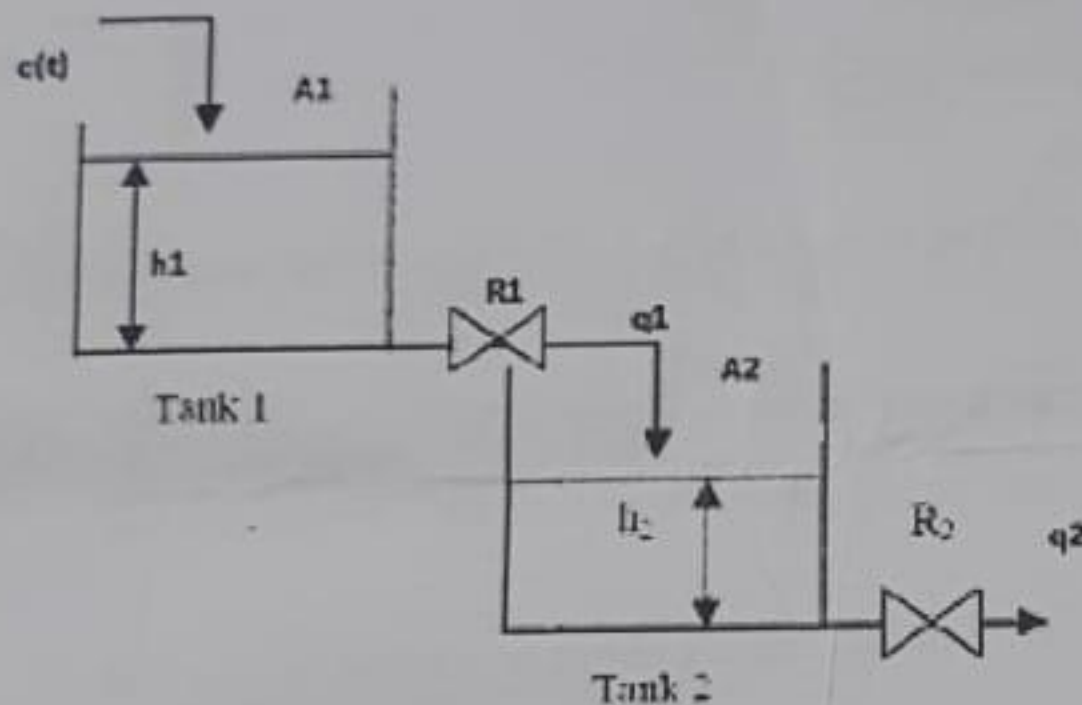
Max. Marks: 100

- KEEPING MOBILE PHONE/ELECTRONIC DEVICES EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

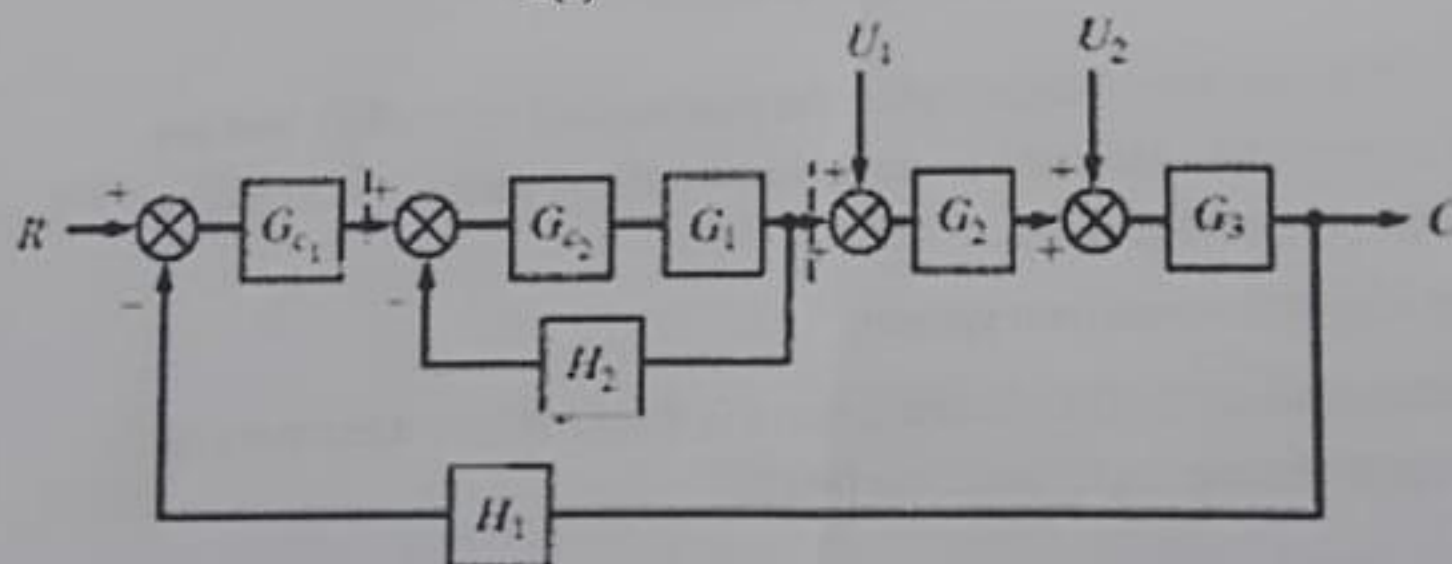
 Answer any **TEN** Questions

(10 X 10 = 100 Marks)

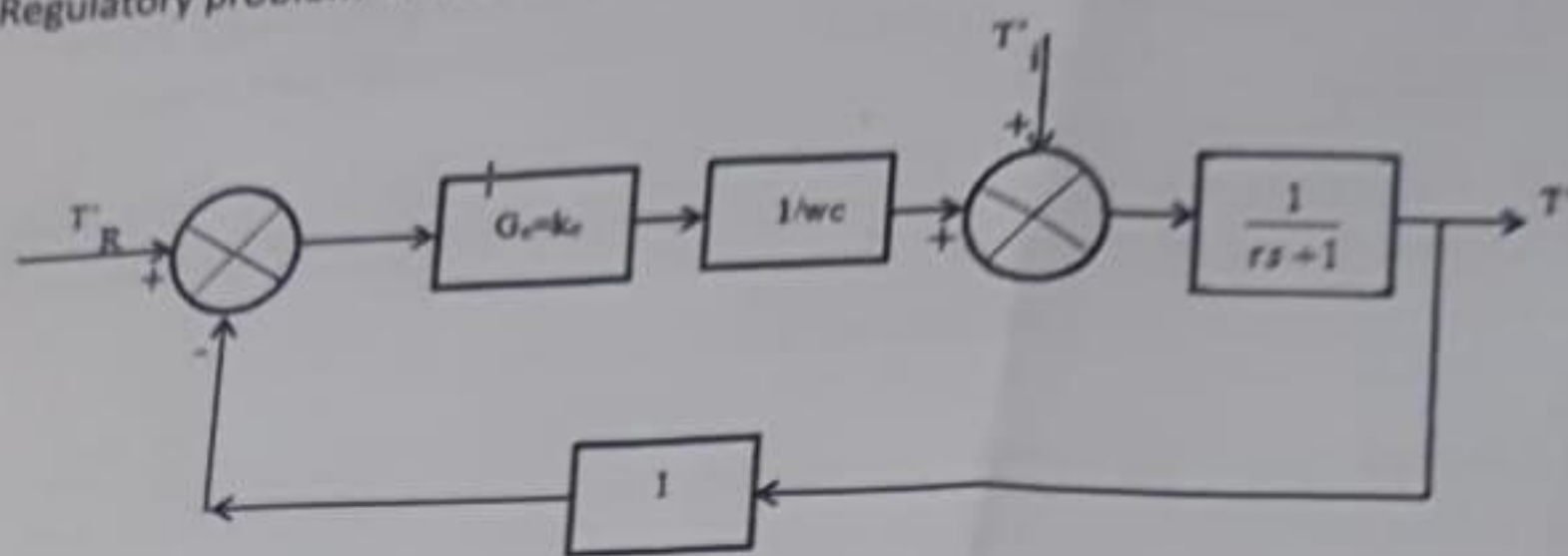
1. Discuss the different measuring instruments used for pressure, temperature, pH, and Composition measurements with working principles and also explain the selection criterion of measuring instruments.
2. Derive the time domain response of the system given below diagram for a unit step change input.



3. Obtain the overall transfer $\frac{C(S)}{R(S)}$ function for following control block diagram



4. Estimate the offset of the following control block diagram by considering the Regulatory problem with a unit step as a forcing function.



5. A feedback control system has the following transfer functions:

Process : $G_p(s) = \frac{5}{[(2s+1)(s+1)]}$

Measurement: $H(s) = \frac{1}{(0.5s+1)}$

Final control element : $G_v(s) = \frac{0.2}{(0.1s+1)}$

Controller : $G_c(s) = K_c$

Using Routh's stability criterion find the range of K_c value for which the system is stable.

6. A unity feedback system has an open loop transfer function $G(s) = \frac{5(1+2s)}{(1+4s)(1+0.25s)}$. Determine the Gain margin and, Phase margin using a Bode plot and comment on the system stability.

7. Elaborate the purpose of tuning in controllers. Discuss about procedure for Z-N and C-C methods of controller tuning.

8. Explain with an example about the Feed Forward Control system as applicable to a chemical process.

9. Draw a neat sketch of the distillation column with the appropriate controllers that are used in industries to control the distillation operation without any issues in the column to continuously separate the components.

Assumption: consider a Binary component system.

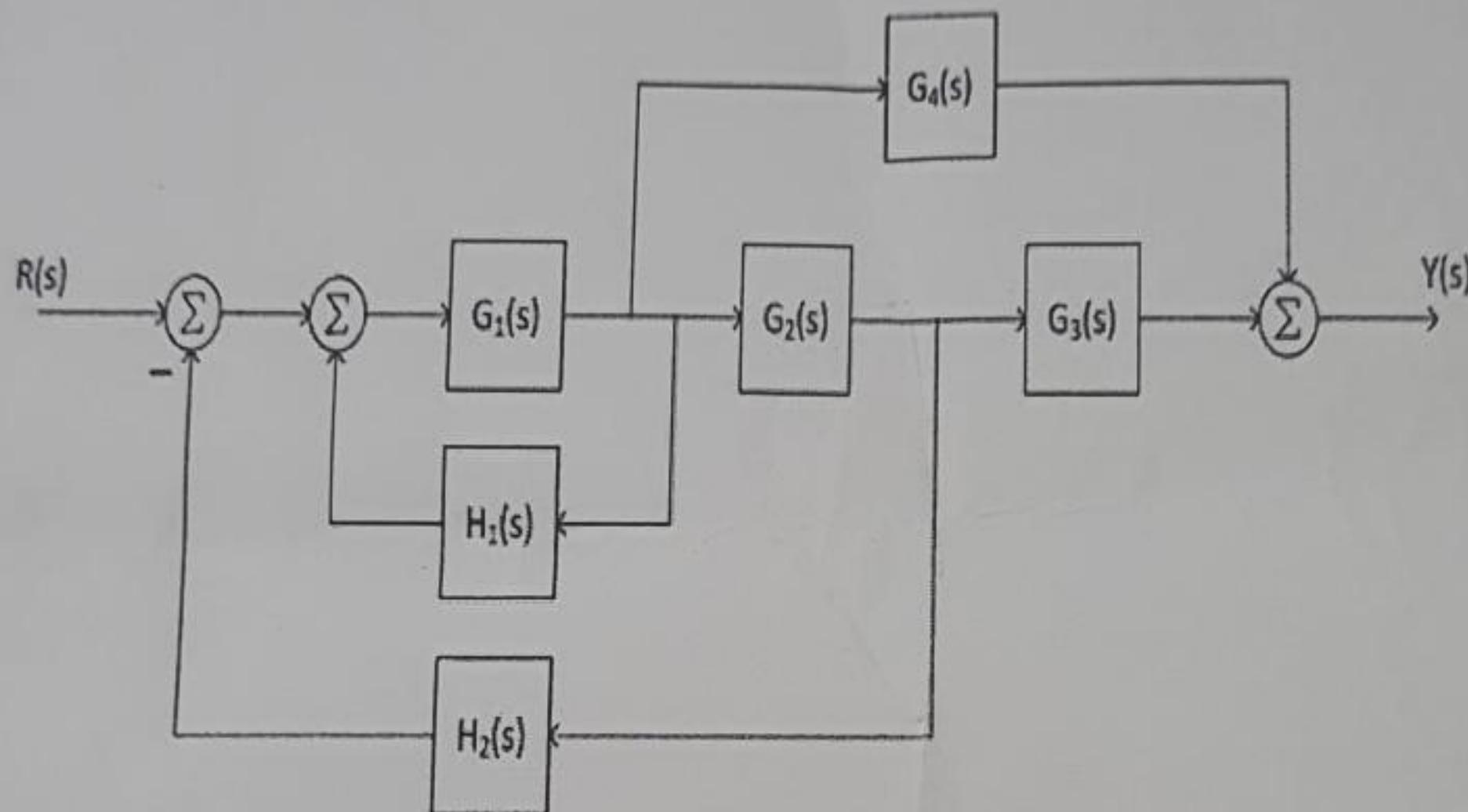
10. Discuss in detail about overview of a Distributed Control System (DCS) and compare its advantages over a Programmable Logic Controller (PLC).

11. Calculate the following terms for the given Transfer function for a unit step input

$$\frac{y(s)}{x(s)} = \frac{1}{s^2 + 0.5s + 1}$$

- (i) Overshoot
- (ii) Decay ratio
- (iii) Period of oscillation
- (iv) Natural period of oscillation
- (v) comment on whether the given system is under/over- damped system with justification

12. Obtain the closed loop and open loop transfer function for the below-given control block diagram and comment on open and closed loop transfer functions.



⇔⇔⇔ H/E/TX ⇔⇔⇔