GUJARAT TECHNOLOGICAL UNIVERSITY
BE- Vth SEMESTER–EXAMINATION – MAY/JUNE - 2012

Subject code: 150504   **Date: 05/06/2012**
Subject Name: Instrumentation & Process Control
Time: 02:30 pm – 05:00 pm   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** A thermometer with time constant 10 sec showing a steady temperature **07**
of 35 ^{o}C is suddenly immersed in heated oil bath at 200 ^{o}C. Find
(i) Time required for temperature reading of 150 ^{o}C.
(ii) Temperature reading on the thermometer after 25 sec.
(iii) The percentage response after 40 sec.

(b) Define 'Stability' and find the stability of the system using Routh stability **07**
criterion having characteristic equation
$S^4 + 4S^3 + 6S^2 + 20S + 15 = 0$

Q.2 **(a)** Discuss the behavior of a tank temperature feedback control system of **07**
agitated heated tank using different kinds of control when it is subjected
to a step change in temperature of inlet stream.

(b) Explain the various terms used to describe an underdamped second order **07**
response.

OR

(b) Derive the equation of unit step response for critically damped second **07**
order system.

Q.3 **(a)** Draw the general block diagram of a simple control system with positive **07**
feedback and explain each term.

(b) What do you mean by open loop transfer function and closed loop **07**
transfer function? Determine the transfer function Y(s) / X(s) for the
following block diagram.
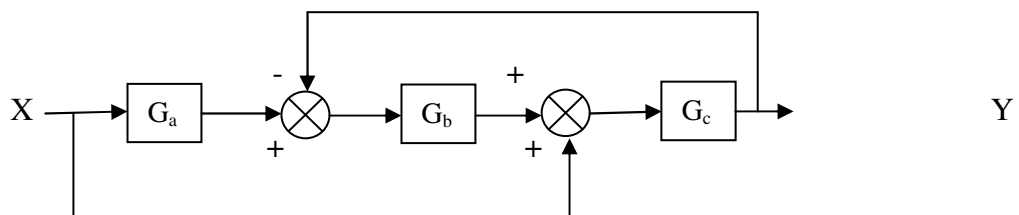
OR
Q.3 **(a)** Draw the block diagram for temperature control system of heated stirred **07**
tank with proportional control and describe the unit step response for set
point change.

(b) Describe the mechanism of control valve and explain the various valve **07**
characteristics qualitatively.

Q.4 **(a)** Calculate Amplitude ratio and Phase angle of first order system for $\omega\tau$ = **07**
0.01, 0.1, 1, 10, 100 and find the true value of Amplitude ratio at corner
frequency.

(b) What are Bode diagrams? Explain the graphical rules for Bode diagrams. **07**
OR

Q.4 **(a)** What do you mean by transportation lag? Derive its transfer function and **07** find the amplitude ratio and phase angle for the same.

(b) Draw the P and I diagram of distillation column and explain it briefly. **07**

Q.5 **(a)** Explain the function of various parts of an instrument and construction of **07** Bourdon gauge.

(b) Mention various temperature measurement devices and explain the **07** temperature measurement by thermocouple.

OR

Q.5 **(a)** Which are the instruments for direct measurement of liquid level? Explain **07** Bubbler system for liquid level measurement.

(b) Explain the principle, construction and working of rotameter. **07**

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