

112/15

Process control & Instrumentation
(3 Hours) [Total Marks : 80]

TE/01/CBA3/BT/PC1
Q.P. Code : 6453

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Note:

1. Question No. 1 is compulsory.
2. Attempt any three questions out of remaining five questions.
3. Assume suitable data wherever necessary.
4. Figures to right indicates full marks.

- Q.1 Answer the following (Any four) 20
- a. Draw a block diagram for feed back control system and explain.
 - b. Differentiate between interacting and non-interacting systems.
 - c. Derive the transfer function for CSTR.
 - d. A thermometer having first order dynamics is placed in a bath of temperature 50°C. After the thermometer reaches the steady state temperature with the bath, the bath is subjected to step change of magnitude 30°C. The time constant of the thermometer is 6 second. Determine the temperature indicated by thermometer at t = 6 second.
 - e. Explain gain margin and phase margin.
- Q.2a. A proportional controller having gain k_c is used to control two non-interacting liquid level tanks having time constants $\tau_1 = 1$ and $\tau_2 = 0.5$. For the unity feed back control system determine the stability of the system using Routh criteria. 10
- b. Discuss the Derive the transfer function for PID controller. Discuss the effect of different modes of control on feed back control system. 10
- Q.3a. The overall transfer function of the control system is given as; 10
- $$G(s) = \frac{16}{1.5s^2 + 2.4s + 6}$$
- a step change of magnitude 6 is introduced into the system. Determine overshoot, period of oscillation, rise time, natural period of oscillation.
- b. Derive that | Offset | = $\frac{1}{1+k_c}$ for controller for regulatory control problem. 10
- Q.4a. Derive the step response equation for first order control system. 10
- b. Derive the transfer function for servo mechanism control problem for positive feed back system. 10
- Q.5a. The open loop transfer function of a control system is given as; 12
- $$G(s) = \frac{k_c (s+1)}{(10s+1)(0.2s+1)}$$
- Sketch the Bode diagram of the control system.
- b. Explain Air to close valve and valve characteristics. 08
- Q.6 Write a short note on (any four) 20
- a. Transportation lag
 - b. P, PD and PID control
 - c. Feed forward control system
 - d. Applications of controllers
 - e. Ratio control