Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2016

Subject Code:2150504 **Date:11/05/2016**

Subject Name:Insrumentation & Process Control

Time:02:30 PM to 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)** Solve the following differential equation by Laplace transform. **07**

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 2x = 2$$
$$x(0) = x'(0) = 0$$

(b) With neat sketch explain the importance of transfer function **07**

Q.2 **(a)** What is Transportation lag? Derive the transfer function of transportation lag. Find Amplitude ratio and phase angle for the same. **07**

(b) A thermometer exhibiting first order dynamics having time constant of 5 sec is at steady state temperature of 25°C. At time t=0, the thermometer is inserted in a bath at 75^{0}c. Show that the value of response reaches 63.2% of ultimate value of response when time elapsed is equal to one time constant. **07**

OR

(b) Derive the transfer function of non-interacting system. **07**

Q.3 **(a)** The transfer function of the second order control system is given as, **07**

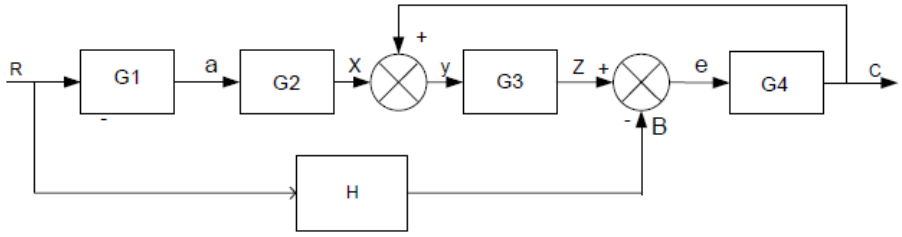
$$G(s) = \frac{16}{1.5s^2 + 2.4s + 6}$$

A step change of magnitude 6 is given in the input variable. Determine,
1) Overshoot 2) Rise time 3) Period of oscillation
4) Maximum value of response 5) Ultimate Value of response

(b) Discuss the transfer function for P, PI and PID controller **07**

OR

Q.3 **(a)** Determine the overall transfer function C(s)/R(s) for the system shown in the following figure. **07**



(b) Explain Servo and Regulator mechanism problem **07**

Q.4 **(a)** Determine the stability if the given control system by Routh Criterion **07**

$$G(s) = \frac{Kc}{s(s = 1)(s + 2)}$$

(b) A proportional derivative controller having the gain Kc and the derivative time is 4 is used to controller two first order non-interacting systems having time constant τ_1=1 and τ_2=0.5. If the gain of the process is 0.5. Sketch the Root locus diagram for the control system. The transfer function of the measuring element is 1/S. **07**

OR

Q.4 **(a)** Derive the offset for first order system controlled by proportional controller and unit step change is given to the set point. **07**

(b) Sketch the asymptotic Bode diagram for the following control system **07**

$$G(s) = \frac{Kc}{(10s + 1)(0.5s + 1)}$$

Q.5 **(a)** Starting with the principal and working, explain the construction of Bimetallic thermometer with neat sketch. **07**

(b) Discuss different static and dynamic characteristics of an instrument. **07**

OR

Q.5 **(a)** Describe variable area meter with neat figure. Also explain the methodology for determination of flow rate with equation. **07**

(b) Enlist different pressure measuring instrument. Explain in detail Bellows pressure gauge for the pressure measurement. **07**

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