Enrolment No.\_\_\_\_\_

## **GUJARAT TECHNOLOGICAL UNIVERSITY** BE – SEMESTER – V (NEW) EXAMINATION – WINTER 2015

Subject Code: 2150504 Date:10/2 Subject Name: Instrumentation & Process Control		Code: 2150504 Date:10/12/ 20 Name: Instrumentation & Process Control	2/ 2015	
Tiı Inst	me:1 tructio 1. 2. 3.	0:30am to 1:00pm       Total Marks:         ons:       Attempt all questions.         Make suitable assumptions wherever necessary.         Figures to the right indicate full marks.	70	
Q.1	(a)	Derive the transfer function for first order system, mercury in glass thermometer. State all assumptions involved. Also derive step response.	07	
	<b>(b</b> )	Solve the following differential equation by using Laplace transform $d^2x/dt^2 + 2dx/dt + x = 1$ where $x(0) = x'(0) = 0$	07	
Q.2	(a)	<ul> <li>Answer the followings:</li> <li>1. State and Prove final value theorem</li> <li>2. Define unit impulse input function and derive its transfer function</li> <li>3. Explain phase margin and gain margin</li> </ul>	07	
	(b)	The overall transfer function of the control system is given as $G(s) = 16/[1.5s^2 + 2.4s + 6]$ A step change of magnitude 6 is introduced into the system. Determine 1.Overshoot 2. Period of oscillation 3. Natural period of oscillation 4. Rise time 5. Ultimate value of response 6. Maximum value of response. OR	07	
	<b>(b)</b>	Derive the transfer function for U tube manometer, second order system.	07	
Q.3	(a) (b)	Write a short note on static characteristics of an instrument. Explain with neat sketch principle and working of Radiation Pyrometer	07 07	
Q.3	(a) (b)	Explain Burdon pressure gauge with neat sketch. Explain working and principle of Rotameter.	07 07	
Q.4	(a) (b)	Discuss in brief indirect level measurement. What is open loop and closed loop transfer function? Determine the transfer function $Y / Y_{sp}$ for the following block diagram.	07 07	
		$D_1$ $D_2$		



OR

- Q.4 (a) State the working principle of manometers. State various types of manometers 07 and explain any one in brief.
  - (b) Plot the bode diagram for the system whose overall transfer function is  $07 \frac{1}{(s+1)(s+5)}$ .

- Q.5 (a) A thermometer having a first order dynamics with a time constant 1 min is placed in a temperature bath at 100 °F. After the thermometer reaches steady state it is suddenly placed in a bath at 110 °F at t=0 and left there for 1 min, after which it is immediately returned to the bath at 100 °F. Calculate the thermometer reading at t=2 min.
  - (b) Derive the overall transfer function of two tanks in series in Interacting manner. 07 OR
- Q.5 (a) The transfer function of a certain control system is defined as G(s) = Kc/(s+1)(s/2+1) (s/3+1)Determine the value of Kc for which the control system is stable by using Routh test for stability.
  - (b) Discuss and compare dynamic response of over damped, under damped and 07 critically damped second order system.

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