Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–V • EXAMINATION – SUMMER • 2014**

**Subject Code: 153501** **Date: 11-06-2014**

**Subject Name: Process Instrumentation, Dynamics and Control**

**Time: 10.30 am - 01.00 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)** Derive transfer function for a system mercury-in-glass thermometer. What is the significance of time constant? **07**

**(b)** Define the following terms: **07**
(i) overshoot
(ii) decay ratio
(iii) response time
(iv) proportional band
(v) rise time
(vi) time constant
(vii) Transfer Function

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

**(b)** Differentiate between positive feedback and negative feedback system. **07**

**OR**

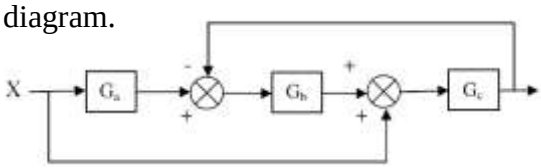
**(b)** Derive overall transfer function for two tanks connected in series Non-interacting system. **07**

**Q.3** **(a)** What is process dynamics? Write a short note on dynamic characteristics of instrument. **07**

**(b)** Write a short note on servo problem vs Regulator problem **07**

**OR**

**Q.3** **(a)** What do you mean by open loop transfer function and closed loop transfer function? Determine the transfer function Y(s) / X(s) for the following block diagram. **07**




**(b)** List out different types of controllers and derive transfer function equation for P-type of controller **07**

**Q.4** **(a)** What are the applications of root locus? Also obtain root locus for a unity feedback system with $G(s) = \frac{k}{S}$ and H(s) =1. **07**

**(b)** Write a short note on DCS with neat figure showing its typical module connections **07**

**OR**

**Q.4** **(a)** Explain Valve sizing and determine the maximum flow through the valve for a pressure drop of 100 psi with a valve of Cv rating 4.0 used to throttle the flow of glycerin for which G = 1.26. **07**

**(b)** Write a short note on Transducers and list out the components of control system **07**

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|---|---|---|---|
| **Q.5** | **(a)** | Describe the principle, construction and working of thermocouple used for temperature measurement. | **07** |
| | **(b)** | What is thermal well? Why is it used? How thermal well affect the dynamic response of the thermometer? | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Classify flow measuring instrument. Also explain the methodology for determination of flow rate with equation for venturi meter. | **07** |
| | **(b)** | Write a short note on Pirari gauge and ionization gauge | **07** |

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