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

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (OLD) - EXAMINATION – SUMMER 2017

Subject Code: 150504 **Date: 27/04/2017**

Subject Name: Instrumentation & 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)** Derive the transfer function relating Head to initial flow rate for the first order liquid level system .Also determine the final steady state value of H(t) when flow rate Q(t) changes according to a unit step change. **07**

(b)1. Explain Impulse input. Derive the equation for the response of a first order system having unit impulse input. **03**

(b)2. Solve the following equation for x(t) **04**

$$\frac{dx}{dt} = \int_0^t x(t)dt - t \quad , \; x(0) = 3$$

Q.2 **(a)** Derive the equation for offset for the P (proportional) control for the load point change. **07**

(b) A step change of magnitude 6 is introduced into the transfer function of the control system given as **07**

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

Determine the overshoot and the frequency of oscillation.

OR

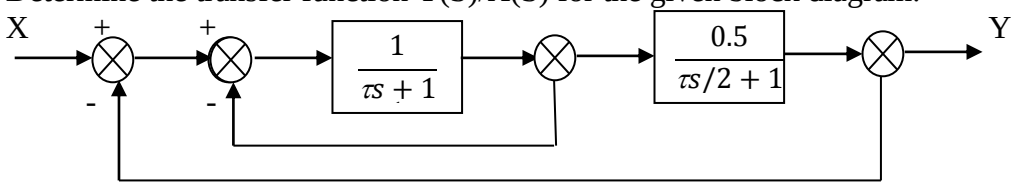
(b) Two non-interacting tanks are connected in series. The time constants are τ_1 = 1, τ_2 = 2 and R_2 = 1. Sketch the response of the tank level 2 if a unit step change is made in the inlet flow rate to tank 1. **07**

Q.3 **(a)** Explain 'air to open' and 'air to close' control valve in detail. **07**

(b) Discuss the response of a typical control system with effect of P, PI, PD and PID modes of the controller. **07**

OR

Q.3 **(a)** Determine the transfer function Y(S)/X(S) for the given block diagram. **07**



(b) Explain 'Rotameter' for flow measurement in detail. **07**

Q.4 **(a)** The open loop transfer function of the control system is given as **07**

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

Sketch the root locus diagram of the system.

(b) Draw P & I diagram for the shell and tube heat exchanger and discuss it in detail. **07**

OR

Q.4 **(a)** The open loop transfer function of control system is given as **07**

$$G(S) = \frac{Kc}{(0.1s+1)(s+1)}$$

		Sketch the asymptotic Bode diagram.	
	(b)	Explain Positive and Negative feedback system in detail.	**07**
Q.5	**(a)**	Explain terms used for the static characteristics of an instrument. 1. Accuracy 2. Static error 3. Reproducibility 4. Drift 5. Sensitivity 6. Dead Zone 7. Span	**07**
	(b)	Write in detail about 'liquid column manometers'.	**07**
		OR	
Q.5	**(a)**	Write in detail about 'float and tape' type liquid level measurement system.	**07**
	(b)	Explain 'Thermocouples' in detail.	**07**

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