

6E6061

Roll No. _____

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B. Tech. VI-Sem. (Main & Back) Exam., April/May-2016
Electronic Instrumentation & Control Engineering
6EI1A Process Control System

Time: 3 Hours

Maximum Marks: 80

Min. Passing Marks (Main & Back): 26

Instructions to Candidates:-

Attempt any five questions, selecting one question from each unit. All Questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL _____

2. NIL _____

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UNIT-I

Q.1 Explain the following

- (a) Process degree of freedom with a suitable example. [8]
- (b) Batch and continuous process. [8]

OR

Q.1 (a) derive the transfer function $H(s) / Q(s)$ for the liquid level system shown in fig.1(a). [H and Q are the derivation variables in h and q, respectively] [8]

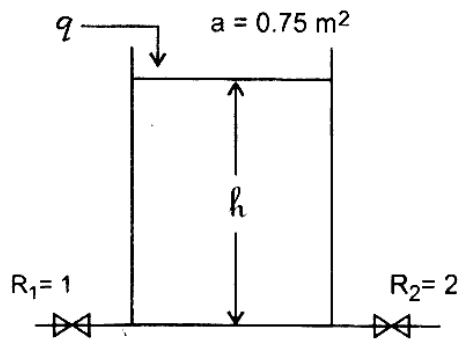


Fig. -1(a)

- (b) There are N storage tanks of volume V arranged so that when water is fed into first tank, equal volume of liquid overflows from the first tank to the second tank and so on. Each tank initially contains zero concentration of component A and equipped with a perfect stirrer. At time zero, a stream of concentration ' C_0 ' of component A is fed into first tank at q volumetric flow rate q . Find the resulting concentration in each tank as a function of time. [8]

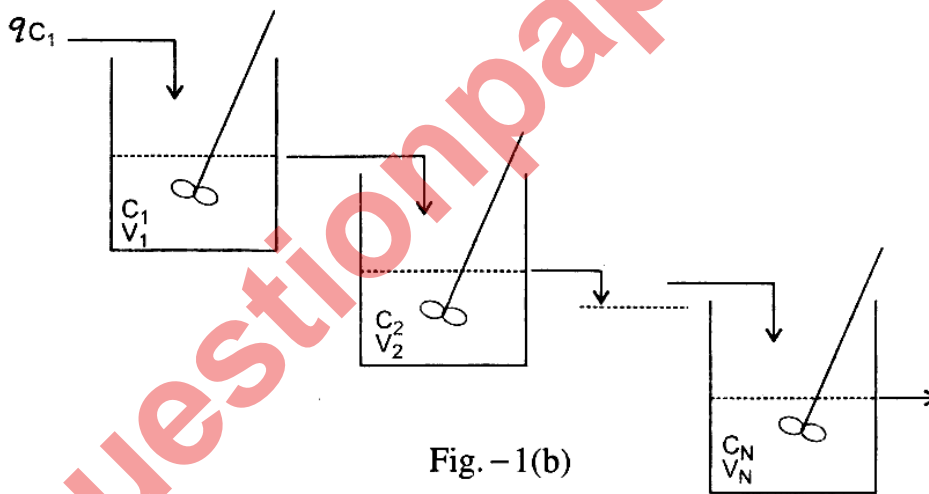


Fig. -1(b)

UNIT-II

- Q.2 (a) A tank system having a time constant of 0.5min. and a resistance of 0.25 min/m^2 is operating at steady state with an inlet flow of $2 \text{ m}^3/\text{min}$. The flow is suddenly increased to $3 \text{ m}^3/\text{min}$. Plot the response of the tank level (assume area of cross section $A = 2 \text{ m}^2$) [8]
- (b) Explain the response of thermometer bulb. [8]

OR

Q.2 A step change of magnitude 5 is introduced into a system having the transfer function

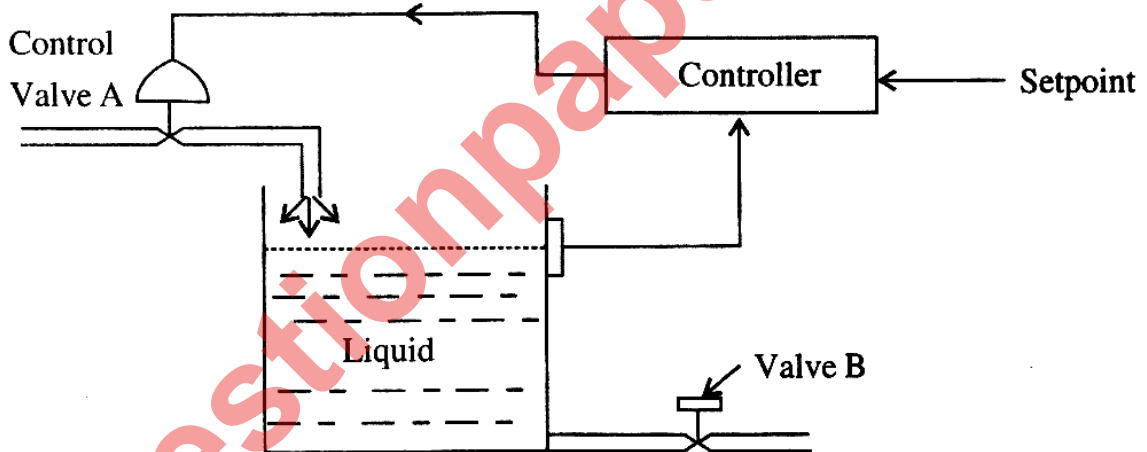
$$\frac{Y(s)}{X(s)} = \frac{8}{s^2 + 1.6s + 4} \quad \text{Determine} \quad \text{rtuonline.com}$$

- (a) Percentage peak over shoot
- (b) Ultimate value of $Y(t)$
- (c) Maximum value of $y(t)$
- (d) Period of oscillation
- (e) Rise time

$$[(4 \times 3 = 12) + (1 \times 4 = 4) = 16]$$

rtuonline.com **UNIT-III**

Q.3 (a) Consider the proportional mode level control system shown below. The valve A is linear with a flow factor of $10 \text{ m}^3/\text{hr}$ percent controller output. The controller output is nominally 50% with a proportional gain $K_p = 10\%$. A load change occurs when flow through valve B changes from $500 \text{ m}^3/\text{hr}$ to $600 \text{ m}^3/\text{hr}$. Calculate the new controller output and offset error. [8]



rtuonline.com Fig. - 3(a)

(b) A PI - controller indicates an output of 12mA when the error is zero. The set point is suddenly increased to 14mA and the controller output is recorded and is given below.

Time t, sec.	0	10	20	30
Output mA	14	16	18	20

Find K_p and T_I

[8]

OR

Q.3 Explain all the tuning methods of controllers in detail.

[16]

UNIT-IV

Q.4 Explain the following performance index.

- (a) IAE
- (b) ISE
- (c) ISTE
- (d) ITAE.

[4×4=16]

OR

Q.4 Explain the following

- (a) Flapper Nozzle System
- (b) Comparison of electrical, pneumatic and hydraulic actuators.

[8]

[8]

UNIT-V

Q.5 Explain

- (a) Feed forward optimization of a steam heater
- (b) The application of cascade control for a batch type fluid bed dryer.

[8]

[8]

OR

Q.5 (a) Develop the suitable control schematic for a mixing station where GAS "A" and GAS "B" are to be mixed to get GAS "C". The requirement is to get variable volume of GAS "C" but with constant calorific value of 3000Kcals/Nm³ (Assume calorific value of GAS "A" and GAS "B" as 4000Kcals/Nm³, and 1000 Kcals/Nm³ respectively.)

[8]

(b) Explain the Boiler – drum control with suitable diagram.

[8]