# P P SAVANI UNIVERSITY

**Fifth Semester of B. Tech. Examination**

**November 2022**

**SECH3030 Instrumentation & Process Control**

**29.11.2022, Tuesday** **Time: 10:00 a.m. To 12:30 p.m.** **Maximum Marks: 60**

***Instructions:***

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

## SECTION – I

| | | | | |
|---|---|---|---|---|
| **Q - 1** | Answer the Following: (Any two) | **[05]** | **CO** | **BTL** |
| **(i)** | Final control element | | **1** | **1** |
| **(ii)** | Negative feedback | | **1** | **1** |
| **(iii)** | Ramp input | | **2** | **1** |
| **(iv)** | Offset | | **4** | **1** |
| **Q - 2** | Find x(s) for the following differential equations. | **[10]** | **2** | **5** |

(a)

$$\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 3x = u(t) \quad x(0) = x'(0) = 0$$

(b)

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + x = u(t) \quad x(0) = x'(0) = 1$$

**OR**

| | | | | |
|---|---|---|---|---|
| **Q - 2** | Draw a block diagram for the control system generated when a human being steers an automobile. | **[10]** | **1** | **4** |
| **Q - 3** | Drive the transfer function of mercury in glass thermometer with assumptions. | **[10]** | **2** | **4** |

**OR**

| | | | | |
|---|---|---|---|---|
| **Q - 3** | A step change of magnitude 4 is introduced into the transfer function | **[10]** | **2** | **5** |

$$\frac{Y(s)}{X(s)} = \frac{10}{s^2 + 1.6s + 4}$$

Determine

( a ) Percent overshoot

( b ) Maximum value of Y ( t )

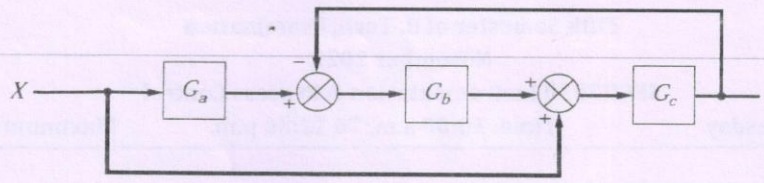
( c ) Ultimate value of Y ( t )

( d ) Period of oscillation

| | | | | |
|---|---|---|---|---|
| **Q - 4** | Attempt any one. | **[05]** | | |
| **(i)** | Control valves (Air to open and Air to close) | | **3** | **2** |
| **(ii)** | Block diagram of a control system | | **3** | **1** |

## SECTION – II

| | | | | |
|---|---|---|---|---|
| **Q - 1** | Answer the Following: (Any two) | **[05]** | | |
| **(i)** | PID controller | | **4** | **2** |
| **(ii)** | Servo problem | | **3** | **2** |
| **(iii)** | Negative feedback | | **3** | **1** |
| **(iv)** | Transfer function | | **2** | **1** |
| **Q - 2** | Determine the overall transfer function Y(s)/X(s). | **[10]** | **3** | **3** |




**OR**

| | | | | | |
|---|---|---|---|---|---|
| **Q - 2** | (i) | Discuss the Routh stability criteria with three theorems. | **[10]** | **5** | **5** |
| | (ii) | Given the characteristic equation below, determine the stability by the Routh criterion. | | | |

$$s^4 + 3s^2 + 5s^2 + 4s + 2 = 0$$

| | | | | | |
|---|---|---|---|---|---|
| **Q - 3** | Draw the P and ID diagram for shell and tube heat exchangers with explanation. | | **[10]** | **1** | **6** |

**OR**

| | | | | | |
|---|---|---|---|---|---|
| **Q - 3** | Discuss various temperature measuring devices with neat diagram. | | **[10]** | **1** | **1** |
| **Q - 4** | Attempt any one. | | **[05]** | | |
| **(i)** | Write a short note on P & ID diagram. | | | **1** | **2** |
| **(ii)** | Write a short note on element of an instrument. | | | **1** | **1** |

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CO : Course Outcome Number BTL : Blooms Taxonomy Level

Level of Bloom's Revised Taxonomy in Assessment

| | | |
|---|---|---|
| 1: Remember | 2: Understand | 3: Apply |
| 4: Analyze | 5: Evaluate | 6: Create |