Total number of printed pages:02 **Diploma(D)/5th/DIE501**

2023

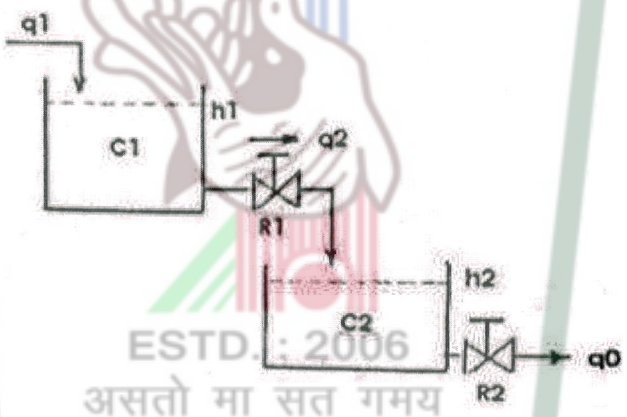
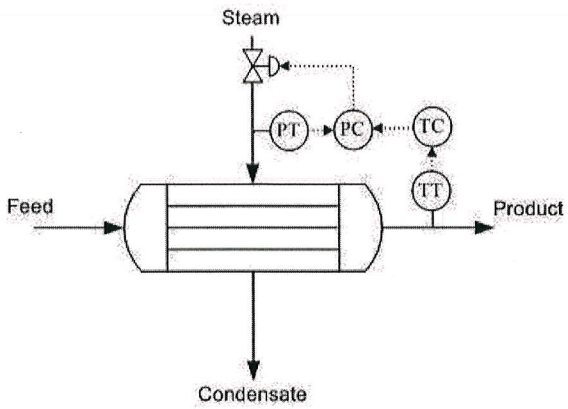
Process Control

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1.	a)	What are the needs of process control, its advantages and explain the process variables with suitable example?	3+2+5
	b)	2.Derive the transfer function of non-interacting tank system as show in Fig: 1 and find the time constants, if C_1(Tank area)=2, C_2=1, R_1(Restriction)=1 & R_2=2, respectively.  Figure. 01	10
2.	a)	P&ID diagram: Identify the process and P&ID representations for the below Fig.2?  Figure. 02	10

<table>
<tr><td></td><td>b)</td><td>Distinguish between servo and regulation operation?</td><td>4</td></tr>
<tr><td></td><td>c)</td><td>What is degree of freedom, explain it with suitable example for physical process?</td><td>3+3</td></tr>
<tr><td>3.</td><td>a)</td><td>Define damping ration. Depending on damping ratio, how the second order systems are classified? Explain it with the neat sketch?</td><td>2+4+4</td></tr>
<tr><td></td><td>b)</td><td>What is two position controllers, explain it with a suitable example?</td><td>10</td></tr>
<tr><td>4.</td><td>a)</td><td>Compare the advantages of PID controller over P, PI and PD controllers?</td><td>6</td></tr>
<tr><td></td><td>b)</td><td>Design and derive the gains of Electronic PID Controller?</td><td>8</td></tr>
<tr><td></td><td>c)</td><td>The PI controller indicates an output of 12mA when the error is zero. The set point is suddenly increased to 14 mA and the controller output is recorded and is given below.
<table>
<tr><td>Time t, sec</td><td>0</td><td>10</td><td>20</td><td>30</td></tr>
<tr><td>Output mA</td><td>14</td><td>16</td><td>18</td><td>20</td></tr>
</table>
Find Kp and Ti</td><td>6</td></tr>
<tr><td>5.</td><td>a)</td><td>What is a final control element and define an actuator?</td><td>2+2</td></tr>
<tr><td></td><td>b)</td><td>Describe the working principle of I/P converter, with a neat sketch?</td><td>8</td></tr>
<tr><td></td><td>c)</td><td>What are the inherent characteristics of a control valve and its types with the governing equations?</td><td>8</td></tr>
<tr><td>6.</td><td>a)</td><td>What is cascade control? Explain it with a suitable example.</td><td>8</td></tr>
<tr><td></td><td>b)</td><td>What is selective control system, explain it with any one example/type?</td><td>8</td></tr>
<tr><td></td><td>c)</td><td>Find i) the proper C_v for a valve that must allow 220 gallons of ethyl alcohol per minute with a specific gravity of 0.8 at a maximum pressure drop of 60 psi, and ii) the required valve size making use of the valve flow coefficient (K_v) table given below.
<table>
<tr><th>Valve size cms</th><th>K_v</th><th>Valve size cms</th><th>K_v</th></tr>
<tr><td>0.75</td><td>0.25</td><td>7.50</td><td>95</td></tr>
<tr><td>1.25</td><td>2.50</td><td>10.00</td><td>150</td></tr>
<tr><td>2.50</td><td>12.0</td><td>15.00</td><td>350</td></tr>
<tr><td>3.75</td><td>30.0</td><td>20.00</td><td>625</td></tr>
<tr><td>5.00</td><td>50.0</td><td>25.00</td><td>974</td></tr>
</table></td><td>4</td></tr>
<tr><td>7.</td><td colspan="2">Write short notes on any four of the following (with example)</td><td>4x5=20</td></tr>
<tr><td></td><td>a)</td><td>Feed forward</td><td></td></tr>
<tr><td></td><td>b)</td><td>Ratio control</td><td></td></tr>
</table>

	c)	Solenoid Valve	
	d)	Hierarchy of process control	
	e)	Split range control	
	f)	Adaptive control	

END