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

2022

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)	Why process control is needed in industries?	3
	b)	Describe a typical first order liquid level system and obtain its mathematical model.	5
	c)	With example, explain servo and regulation operation	6+6=12
2.	a)	What is degree of freedom, explain it with suitable example for physical and chemical processes?	10
	b)	What is time constant and dead time in the process?	4+3=7
	c)	What are the characteristics of first order system?	3
3.	a)	Compare the features of ON-OFF, P, PI, PD and PID control modes (definition, limitations, advantages and disadvantages). Also draw their characteristics?	10
	b)	The PI controller indicates an output of 18mA when the error is zero. The set point is suddenly increased to 20 mA and the controller output is recorded and is given below. Time t, sec: 0, 10, 20, 30, 40 Output mA: 20, 24, 28, 32, 36 Find Kp and Ti	10
4.	a)	Design and derive the gains of Electronic PI Controller?	12
	b)	The temperature range of a temperature controller is 300 ºC to 600 ºC. The set point is kept at 350 ºC. Find the percentage of span error and the measured value as percentage of measurement range, when the temperature is i) 400, ii) 420 & iii) 440	6

<table>
<tr><td></td><td>c)</td><td>The standard measurement indication range of a transducer is 4-20 mA. If we have a set point value of 13 mA and a measurement of 13.7 mA, calculate the error expression as percentage of span.</td><td>2</td></tr>
<tr><td>5.</td><td>a)</td><td>Describe the working and mathematical model of a pneumatic actuator, with neat sketch?</td><td>6</td></tr>
<tr><td></td><td>b)</td><td>What are the three different inherent characteristics of a control valve?</td><td>10</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>6.</td><td>a)</td><td>What is cascade control? Explain the need for cascade control with an example and its schematic representation?</td><td>10</td></tr>
<tr><td></td><td>b)</td><td>What is selective control system, explain override control to protect boiler system?</td><td>10</td></tr>
<tr><td>7.</td><td colspan="2">Write short notes on any four of the following</td><td>4x5=20</td></tr>
<tr><td></td><td>a)</td><td>Hierarchical computer control system</td><td></td></tr>
<tr><td></td><td>b)</td><td>Drying process</td><td></td></tr>
<tr><td></td><td>c)</td><td>Heat exchanges</td><td></td></tr>
<tr><td></td><td>d)</td><td>Distillation process</td><td></td></tr>
<tr><td></td><td>e)</td><td>Compare between feed forward control and feedback control</td><td></td></tr>
<tr><td></td><td>f)</td><td>Electrical actuator (any one example)</td><td></td></tr>
</table>

END