WEST BENGAL UNIVERSITY OF TECHNOLOGY

EI-601

PROCESS CONTROL-I

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable. All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. $10 \times 1 = 10$

(i) A cascade controller is used when the process

(A) gain is too small
(B) gain is too large
(C) has widely different two time constants
(D) oscillation of the output is not permitted

(ii) The function of reset action in a process controller is to

(A) reduce rise time
(B) reduce steady state error
(C) reduce oscillation in the response
(D) increase overall gain

(iii) Which of the following controllers is not a continuous action type?

(A) PID (B) ON-OFF

(C) cascade (D) proportional

(iv) The order of a system having two storage elements is

(A) 1^{ST} (B) 2^{ND}

(C) 3^{RD} (D) 4^{TH}

(v) The transfer function of a Dead time element

(A) $\exp(\tau_d s)$ (B) $\exp(s)$

(C) $\exp(-\tau_d s)$ (D) $1/(s\tau+1)$

(vi) Which valve is used for pressure control

(A) globe valve (B) butterfly Valve

(C) check valve (D) none of these

(vii) A process controller output is 4-20 mA. The output 4mA is known as

(A) offset zero (B) dead zero

(C) absolute zero (D) live zero

(viii) An example of industrial control system (ICS) is

(A) PLC (B) DCS

(C) both PLC & DCS (D) none of these

(ix) Spring diaphragm actuator non-linearity are overcome by the use of

(A) I/P converter (B) positioners

(C) solenoid valves (D) air pressure regulator

(x) If proportional band (PB) of a P controller is very wide then the system response is

(A) sluggish (B) perfect tracking

(C) unstable (D) none of these

(xi) Butterfly valve is used for-

(A) high shut off (B) fully closed

(C) high gain (D) none of these

(xii) The characteristics equation of a system is $(s^2+2s+2=0)$. The system is

(A) critically damped (B) under damped

(C) over damped (D) unstable

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. What is proportional band? Explain the working principle of time-proportional control. How is time proportional control different from On-Off control? 1+3+1=5

3. Explain the Ziegler – Nichols Method for tuning of controller. 5

4. Explain in brief the uses of Mathematical Modelling in process control. 5

5. Implement an electronic PI controller using operational amplifier, having proportional gain of 4.7 and reset time of 3 sec. 5

6. What is pneumatic controller? Describe with proper diagram the function of pneumatic relay in a pneumatic controller. 1+4

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) Explain the principle of ON-OFF controller. 2
   (b) What are the main components of digital control loop in feedback process? Explain an algorithm which is used in PID controller tuning. 5+4
   (c) Explain I-P converter? 4

8. (a) Mention the source of disturbance in process control studies. 4
   (b) Explain the basic process control loop with proper diagram. What is multistage control scheme? 4+3
   (c) What is offset? Why does it appear? How is it eliminated? 1+1+2

9. (a) What is heat exchanger? What are the applications of heat exchanger? 3+3
   (b) Define ratio control with proper diagram? 5
   (c) Explain PI control loop with control valve as the final control element. 4

10.(a) What do you mean by cavitation in control valve? How is it eliminated? 3+3
   (b) Explain the working principle of valve positioner, and discuss its advantages over control valve. 2+4
   (c) Explain with proper diagram sliding stem control valve. 3

11. Write short notes on any *three* of the following: 3×5
   (a) Distillation column
   (b) DCS
   (c) Combustion control
   (d) PID tunning
   (e) Self regulation
   (f) PLC.