

Total No. of printed pages = 3



2021

PROCESS CONTROL

Full Marks – 100

Time – Three hours

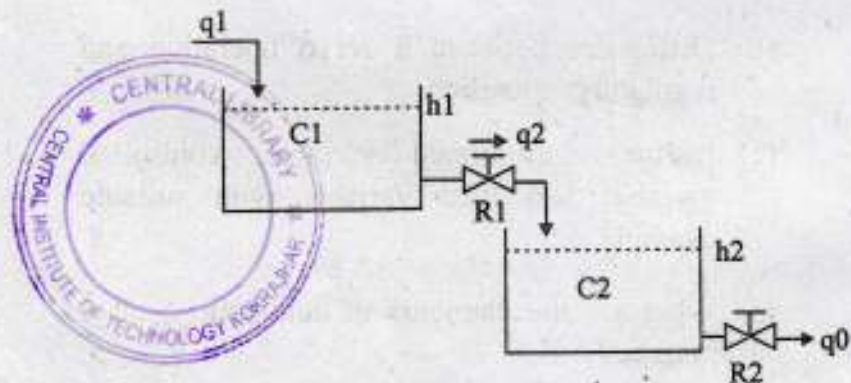
The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Why process control needed in industry ? 3
- (b) Difference between a servo operation and regulatory operation. 4
- (c) Define manipulated variable, controlled variable and load variable with suitable example. 8
- (d) What are the elements of automatic control system ? 5
2. (a) What is degree of freedom ? 2
- (b) Write down the different instrument terms and symbols used in Piping and Instrumentation diagram. 6

[Turn over

- (c) What is the significance of PID controller over on-off, P, PI and PD controllers? Design an electronic proportional controller? 12
3. (a) What is meant by Controller tuning? Explain any two controller tuning methods. 12
- (b) For a unity feedback system, process transfer function is given by $G_p(s) = \frac{4}{(3s+1)(6s+1)(9s+1)}$. Controller is proportional and all other elements have unity transfer function. Calculate the optimal values of P, PI and PID controllers parameters based on ultimate cycle method of tuning. 8
4. (a) Derive the transfer function $(Q_o(s)/Q_i(s))$ of the system shown below: 8



- (b) Explain the construction and working of current to pressure converter (I/P) and pneumatic actuator with the neat sketch. 12

5. (a) Explain cascaded controller with example. 8
- (b) Describe selective controller with two suitable example. 12
6. (a) Briefly explain the selection of control valves. 2
- (b) What are the inherent characteristics of control valves? 8
- (c) Explain any five types of control valves with neat diagram. 10

