

(3 Hours)

[ Total Marks : 100

- N.B.** (1) Question No. 1 is **compulsory**.  
(2) Solve any **four** out of remaining **six** questions.  
(3) Assume suitable data wherever **required** with justification.  
(4) Draw neat **circuit** and/or block **diagram** to support your answers.

1. Solve any **four** :-

- |     |   |    |
|-----|---|----|
| (a) | Explain process equation, process load, process lag self regulation and control lag with suitable example.  | 5  |
| (b) | Compare pLC, SCADA and fuzzy controller   | 5  |
| (c) | Explain pH measurement with diagram.  | 5  |
| (d) | Describe the manufacturing process for "making paper"   | 5  |
| (e) | Explain brief the construction and principle of operation of strain gauge.  | 5  |
| 2.  | (a) Define Reynold number, what is Bernoulli's equation, explain venturimeter for flow measurement, also write flowrate equation of it.   | 10 |
|     | (b) Explain any one process along with control diagram in the food industry.  | 10 |
| 3.  | (a) A process is to operate under PID with a 60% PB. 1-2 min. integration time and 0.05 min derivative time. If the error is available as percent of span, develop the control equations and show a flow chart of computer controller action with all constants evaluated. The sample time is 0.8 mins. | 10 |
|     | (b) Explain in detail tuning of pneumatic PID controller.   | 10 |
| 4.  | (a) Explain distillation of hydro carbons in the petroleum industry.  | 10 |
|     | (b) Explain ratio control, cascade control, feed forward control, duplex control, with one example of each mode of control in process instrumentation.  | 10 |
| 5.  | (a) Describe a typical SCADA system used in moderately large instrumentation set-up with a specific example.  | 10 |
|     | (b) Compare RTD and thermistors for temperature measurement. Also write their equations relating resistance and temperatures. What do you mean by thermocouple tables?  | 10 |
| 6.  | (a) Describe self tuning regulator with block diagram and compare its operation with Model reference adaptive control (MRAC).   | 10 |
|     | (b) Explain low, moderate and high pressure measurement. Also for a McLeod gauge has volume of bulb, capillary and tube down to its opening equal to $90 \text{ cm}^3$ and a capillary diameter of 1 mm. Calculate the pressure indicate by a reading of 3 cm.  | 10 |
| 7.  | Write short notes on the following (any <b>four</b> ) :-  | 20 |
|     | (a) H-Infinity design procedure   |    |
|     | (b) Control valves  |    |
|     | (c) Dyeing of fabric  |    |
|     | (d) Instrumentation Amplifier   |    |
|     | (e) Carbonation control system in breweries   |    |
|     | (f) Actuators and pumps.  |    |