

B.Tech. (I.E.E), First Year, Second Semester Examination 2018

PROCESS INSTRUMENTATION – I

Time: Three Hours.

Full Marks: 100

Answer any **FOUR** questions.

Brief and to the point answers shall be appreciated.

1. Explain the following:
 - a) The differences between a 2-wire and a 4-wire electronic transmitter. 4
 - b) Explain how the use of sensors-transmitters in a triple-redundant configuration with median selector logic, helps to enhance the reliability of a measurement system against failures. 7
 - c) Why is an absolute encoder with a larger number of output bits preferred over an encoder with lesser number of bits? 3
 - d) An electronic temperature transmitter is calibrated over a range of 50 to 150°C. Is the zero of the transmitter elevated or suppressed and to what extent? Find: (a) the transmitter output when the temperature is 75°C. (b) The temperature when the transmitter output is 16mA. 6
 - e) What is an I/P converter and why is it used? 5
2. a) Sketch the input-output characteristics of a flapper-nozzle assembly. State the limitations of a flapper nozzle assembly and explain why a pneumatic relay is generally used at its output. 8
- b) With the help of a neat sketch, describe the operation of a pneumatic force balance transmitter. Deduce an equation that relates the input force to the pneumatic output signal. How can the zero and span of the transmitter be adjusted? Justify whether these adjustments independent of one another? 9
- c) Why is an air filter regulator connected to the supply line of a pneumatic instrument? Explain its principle of operation. 8
3. a) What is a pressure tap? Indicate the preferred location of pressure tap for different fluids, on a horizontal pipe as well as a vertical pipe. Describe the installation procedure of a G.P. transmitter in liquid service. 12
- b) Explain how the static pressure of a process fluid flowing through a pipeline may be measured using a purge medium. What is the advantage of such a measurement system? 9
- c) Why is the use of a manifold recommended at the inlet of a pressure measuring device? 4

4. a) With the help of a neat sketch, explain the construction of a capacitive D.P. sensor. Explain the significance of the "H" and "L" markings on the process connections of a DP transmitter. Can a DP transmitter be used for measurement of Gauge pressure? Justify your answer. 11
- b) With the help of a labelled sketch, illustrate the construction of a Bourdon tube pressure gauge (no explanation required). 5
- c) Differentiate between:
1. Absolute pressure and gauge pressure. 3
 2. Set pressure and differential in the context of a pressure switch. 3
 3. Gravity dependent and gravity independent unit of pressure. 3
5. a) Explain the principle of operation of an inductive proximity switch. Define "sensing range" and state the factors that influence it. How can such a sensor be made directive so that it detects targets that approach the sensor along a specific axis. 10
- b) Describe the principle of operation of a drag-cup eddy current tachometer. 5
- c) Differentiate between a proximity switch with PNP output stage and a NPN output stage. 3
- d) Name the output signals generated by an incremental encoder and explain how these may be used for the measurement of i) angular displacement, ii) angular velocity, iii) direction of rotation. 7
