

December 2019

**PROCESS INSTRUMENTATION – II***Time Allowed: 3 Hours**Full Marks: 70***Answer to Question No.1 is compulsory and to be answered first.****This answer is to be made in separate loose script(s) provided for the purpose.****Maximum time allowed is 45 minutes, after which the loose answer scripts will be collected and fresh answer scripts for answering the remaining part of the question will be provided.****On early submission of answer scripts of Question No.1, a student will get the remaining script earlier.****Answer any five questions from Group-A & B, taking at least two from each group.**

1. Answer the following questions (any twenty): 20x1
- i) Temperature is that parameter which defines the direction of heat flow between two substances. (I) True (II) False
  - ii) What is ITS 90 in conjunction with temperature measurement?
  - iii) As a filling liquid Xylene has the range of \_\_\_\_\_ to \_\_\_\_\_ °C.
  - iv) Bimetallic thermometer works on the principle of \_\_\_\_\_.
  - v) Reverse of seebeck effect is known as \_\_\_\_\_.
  - vi) For precise temperature measurement \_\_\_\_\_ wire RTD is best suited when compared to the others.
  - vii) Thermistor is more non-linear compared to RTD. (I) True (II) False
  - viii) Sensitivity of thermistor is \_\_\_\_\_ compared to RTD.
  - ix) For wide range temperature measurement thermistor is more suitable compared to RTD. (I) True (II) False.
  - x) Non contact type temperature measurement is performed when the temperature is very \_\_\_\_\_.
  - xi) What are those materials by which thermistors are manufactured?
  - xii) What is Reynolds number?
  - xiii) Mention the name of different types of orifice plate used for flow measurement purpose.
  - xiv) Bernoulli's theorem deals with the principle of conservation of pressure. (I) True (II) False
  - xv) Venturi meter is a head type flow meter. (I) True (II) False
  - xvi) Electromagnetic type flow measurement is only possible if the flowing fluid is \_\_\_\_\_.
  - xvii) Define "Hazardous area".
  - xviii) What are the essential elements for combustion?
  - xix) What do you understand by deflagration?
  - xx) What is detonation?
  - xxi) What are those properties of an area indicated by class?
  - xxii) What are the different methods used for hazard reduction in process industries?
  - xxiii) Current transmission is more suitable compared to voltage transmission. (I) True (II) False.
  - xxiv) Define the meaning of each letter in the word 'SMART' in connection with SMART sensor.

**Group-A**

2. Write a short note on ITS 90. What are the different types of bulb are in common use in case of filled of system. With a relevant diagram explain how temperature measurement can be done with the help of a filled in system. 2+2+4
3. What are the different materials used for the construction of RTD? Why Platinum is superior over the other materials? How error due to lead wire resistance is eliminated in 4 wire RTD? Why thermistor is used for small span temperature measurement? Write the name of the different materials used for the manufacturing of thermistor. 1+1+4+2+2

4. With a detail diagram explain how radiation pyrometer is used for high temperature measurement. How AD590 can be used in conjunction with thermocouple for cold junction compensation? With specifications, give an example of semiconductor type temperature sensor. 5+3+2
5. With a circuit diagram explain one level measurement technique by using capacitive sensor. What are the different materials used for manufacturing of float? How level measurement can be done by using ultrasonic waves? 5+2+3
6. Write Bernoulli's Theorem. By using Bernoulli's theorem show that for a flowing stream the flow rate is directly proportional to the square root of the differential pressure. What are the advantages of using orifice plate for flow measurement purpose? 3+5+2

**Group-B**

7. Why current signal transmission is superior over voltage transmission in case of analog industrial communication? What are those aspects under which it can be considered that SMART sensor is more superior over conventional sensor? What is the function of preprocessor in SMART sensor? How the 1<sup>st</sup> generation SMART sensor deviates from the 2<sup>nd</sup> generation SMART sensor? 2+2+2+4
8. Draw a general architecture of SMART sensor and explain. Explain the basic operation of the sample and hold circuit. What are the different types of topologies used for industrial communication purpose? 5+3+2
9. What are those benefits we get if the communication takes place by using HART protocol? Briefly explain the following in connection with HART communication (I) Master slave mode (II) Burst mode. How HART signal is superimposed on the conventional 4-20 mA signal? 3+2+2+3
10. Draw the seven layer of OSI model and explain the function of any two layers. 2+4+4
11. What is Foundation Fieldbus? Communication using Fieldbus is superior over conventional 4-20 mA analog communication- Explain. With a diagram show that how the field devices are connected in Daisy Chain and Mixed topology? 2+4+2+2