

M.TECH/AEIE/1<sup>ST</sup> SEM /AEIE 5103/2015  
2015

Advanced Industrial Instrumentation  
(AEIE 5103) 8

Time Allotted : 3 hrs

Full Marks : 70

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

Group - A  
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following: 1×10=10
- (i) The desirable property of a manometric fluid is:  
(a) High viscosity (b) High coefficient of thermal expansion  
(c) Low vapour pressure (d) Corrosiveness and stickiness.
- (ii) The Primary standard for calibrating vacuum is  
(a) McLeod gauge (b) Dead weight tester  
(c) Thermocouple gauge (d) Kundsén gauge.
- (iii) A flow meter that measures flow independent of density is  
(a) Rotameter (b) Electromagnetic flow meter  
(c) Venturi meter (d) Orifice meter.
- (iv) The meter which is suitable for flow totalization is  
(a) Turbine meter (b) Venturi meter  
(c) Ultrasonic flow meters (d) Orifice meter.
- (v) A pressure gauge is used to measure vacuum indicates a gauge pressure of 5 kPa. If the atmospheric pressure is 100 kPa, the absolute pressure is  
(a) 95 kPa (b) 0.05 kPa  
(c) 105 kPa (d) 20 kPa.
- (vi) Zirconium probe is commonly used to analyse \_\_\_\_\_ content of flue gas.  
(a) CO<sub>2</sub> (b) O<sub>2</sub>  
(c) NO<sub>x</sub> (d) SO<sub>x</sub>.

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- (vii) The thermocouples are  
(a) Passive transducers (b) Both active and passive transducers  
(c) Active transducers (d) Output transducers.
- (viii) A Pt<sub>100</sub> RTD has resistance  
(a) 0 Ω at 0°C (b) 0 Ω at 100°C  
(c) 100 Ω at 0°C (d) 100 Ω at 100°C
- (ix) Function of primary air in coal fired furnace is to  
(a) Carry the dust coal into the furnace  
(b) Provide necessary oxygen for combustion  
(c) Maintain the furnace draft  
(d) None of these.
- (x) Released electrical or thermal energy from an intrinsically safe instrument under normal or abnormal condition should be \_\_\_\_\_ the ignition energy of a specific flammable or combustible atmospheric mixture.  
(a) above (b) below  
(c) equal to (d) dependent on

**Group - B**

2. (a) Describe the operation of a basic McLeod Gauge. How the same can be linearised?  
(b) Describe with necessary circuit diagram, how the error due to lead resistance can be reduced in 3-wire RTD over the 2-wire RTD.  
**(3+3) + 6 = 12**
3. (a) Describe the hardware method of cold junction compensation with necessary circuit diagram.  
(b) Describe how the thermocouple burnt out can be detected by hardware method?  
**8 + 4 = 12**

**Group - C**

4. Describe the method of level measurement in boiler drum with necessary schematic diagram. Hence draw the computational block diagram for the pressure compensated drum level.  
**(6 + 6) = 12**

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5. (a) Why boiler feed water conductivity is needed to be measured? Explain the process of conductivity measurement of the same.

(b) Why the boiler feed water should be free from dissolved oxygen?

**(2 + 6) + 4 = 12**

**Group - D**

6. (a) Describe the operation and control of a heat exchanger unit in a chemical plant.

(b) Draw the schematic of a distillation column, by showing instruments for measuring process parameters.

**8 + 4 = 12**

7. (a) Describe the method of liquid-gas interface level measurement system in a chemical plant.

(b) State different types of maintenance activity of the instruments.

**6 + 6 = 12**

**Group - E**

8. (a) What is meant by intrinsic Safety? Discuss the working principles of fire, flame and hydrocarbon detectors.

(b) Explain different zones of area classification recommended by the International Electrotechnical Commission (IEC).

**(3+5) + 4 = 12**

9. Describe the working of the Zener barrier devices in intrinsically safe electronic systems with necessary circuit diagram. Hence derive the expression for the maximum total stored energy in the circuit.

**(8+4) = 12**