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# HERITAGE INSTITUTE OF TECHNOLOGY

1st Semester M.Tech. Examination. 2014 Session : 2014-15

**Discipline : AEIE**

Paper Code :AEIE5103 Paper Name : Advanced Industrial Instrumentation

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 alternative from the following: 10 x 1=10

(i) Thermistor, which has high temperature co-efficient of resistivity, is used as the sensing element in resistance thermometesr. It is a/an

a) Insulator b) Conductor
c) Solid semiconductor) d) ) Liquid semiconductor

(ii) Working principle of radiation pyrometer is based on

(a) Wien's law (b) Kirchoff's law
(c)Stefan-Boltzman law (d) Seebeck effect

(iii) Pt-100 means a temperature bulb having

(a) 0 ohm at 0°C (b) 0 ohm at100°C
(c) 100 ohm at 0°C (d) 100 ohm at 100°C

(iv) A non-contact type temperature sensor is a

(a) thermocouple (b) thermistor
(c) pyrometer (d) thermostat

(v) A magnetic flowmeter is

(a) based on the principle of Faraday's law
(b) capable of measuring the flow rate of slurries and electrolytes
(c) based on the linear relationship between the fluid flow rate and the induced voltage.
(d) All of the above

(vi) Orifice meter measures _____ of a flowing fluid

(a) Volumetric flow rate (b) Mass flow rate
(c) Velocity (d) All of the above

(vii) K-type T/C is made of

a) Cu, constantan b) Chromel, constantan
c) Pt, Pt rhodium d) Chromel, alumel.

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(viii) When a bare thermocouple is covered by a protective sheath, the response becomes
(a) Slower and non-oscillatory (b) Faster and non-oscillatory
(c) Faster and oscillatory (d) Slower and oscillatory.

(ix) Which of the following thermocouples will give the highest output for the same value of hot and cold junction temperatures?
(a) Iron-constantan (b) Chromel-constantan
(c) Platinum-platinum + rhodium. (d) Copper – Constantan.

(x) Working principle of Rotameter is
(a) variable head (b) variable area
(c) fixed head and fixed area (d) none of these.

**Group - B**

2. (a) Describe with a neat diagram the operating principle of ultrasonic type level gauge system.

(b) Describe how capacitive level sensor works for a conducting and non-conducting liquid. 6 + 6 =12

3. (a) A differential pressure transmitter measures 2.5 Pa for a flow rate of 0.5 $M^3$/sec when connected to a venture meter. Calculate the approximate flow rate for a differential pressure of $0.9X10^5$ Pa. Derive an expression of flow as a function of height when a fluid is flowing through a rotameter.

(b) A DP transmitter is to be installed in a steam line to measure steam flow. Draw a sketch to install a 5- valve manifold and explain the purpose of each valve. (2+4) + (2+4) = 12

**Group - C**

4.(a) Describe self heating error of RTD. Draw a scheme to minimize the error in measurements due to self heating effect.

(b) State the law of intermediate metals and law of intermediate temperatures of thermocouple. What is meant by cold junction compensation? Draw a neat scheme for the same. (3+3) + (2+1+3)=12

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5.(a) Explain with a neat sketch the construction and working principle of a industry standard method of measuring hydrocarbon (HC) concentration.

(b) Draw the block diagram of Flame Scanner and explain its different blocks. 6 + 6 = 12

**Group - D**

6. (a) What is the actual practice of measuring Steam temperature?

(b) What is dissolved oxygen in water? How can one measure the concentration of dissolved oxygen in water? Describe the construction and working of modified Winkler dissolved oxygen determination technique?

(c) The operator titrates a 200 mL dissolved oxygen sample. The burette reading at the start of the titration was 0.0 mL. At the end of the titration the burette read 7.4 mL. The concentration of the titrating solution was 0.025 N. What is the D.O. concentration in mg/L? 3 + (2+4) +3 = 12

7.(a) What is Coriolis principle? Prove that the torque experienced by the tube is directly proportional to mass flow rate of the fluid.

(b) Describe, with neat sketches, the construction and working of a rotameter. 6 + 6 = 12

**Group - E**

8. (a) What are Zener Diode Barriers? Explain with a neat diagram the working of Zener barriers.

(b) Draw a neat sketch to show the essential parts of a C-type Bourdon tube pressure gauge and explain its principle of operation. Why Bourdon type pressure gauge is installed in delivery line of a boiler feed water pump? (1+3) + (6+2) = 12

9. Write short notes on any **two** of the following:
   a) Vortex Flow meter
   b) Temperature measurement in Distillation tower
   c) Coal quality testing.
   d) Float type level meter
   e) Pollution monitoring equipments (6 x 2) = 12

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