



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech(ICE)/SEM-8/EI-801C/2013**

**2013**

**ANALYTICAL INSTRUMENTATION**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

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

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following questions : 10 × 1 = 10

- i) The desiccant which is used in electrolytic hygrometer is

- |             |           |
|-------------|-----------|
| a) $H_2$    | b) $H_2O$ |
| c) $P_2O_5$ | d) $N_2$  |

- ii) An example of Newtonian fluid is

- |                |
|----------------|
| a) starch      |
| b) chewing gum |
| c) tar         |
| d) kerosene.   |

- iii) What is Beer-Lambert Law ?

- |                    |                   |
|--------------------|-------------------|
| a) $A = abc$       | b) $A = bc$       |
| c) $A = a^2b^2c^2$ | d) none of these. |



- iv) Magnetic susceptibility of paramagnetic gas is
- 0
  - $< 0$
  - $> 0$
  - none of these.
- v) Humidity can be measured in
- cc
  - mole
  - Vppm
  - none of these.
- vi) In hair hygrometer, humidity sensitive component should be
- paper
  - wood
  - animal hair
  - all of these.
- vii) A buffer solution is a solution that
- retains its pH for a long time
  - cannot retain pH for long
  - has no electrolytic property
  - acts as an intermediate solution between two solution of different pH.
- viii) Turbidity is a common criterion to measure
- Water quality
  - Air quality
  - Soil quality
  - None of these.
- ix) Zirconia probe is used for detection of
- He
  - $H_2$
  - $N_2$
  - $O_2$ .
- x) Pyroelectric detector is formed by temperature sensitive
- resistor
  - inductor
  - capacitor
  - diode.
- xi) In vibrating  $U$  tube densitometer, if  $D$  is density,  $t$  is time period of oscillation, then
- $D = At + B$
  - $D = At - B$
  - $D = At^2 + B$
  - $D = At^2 - B$ .



xii) In Electrode method of pH measurement, combination electrode is

- a) Glass electrode with Ag/AgCl electrode
- b) Glass electrode with antimony electrode
- c) Glass electrode with Quinhydrone electrode
- d) None of these.

### GROUP – B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

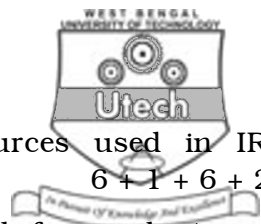
2. Give a comparative study between Pope cell and Dunmore cell in context of humidity measurement. 5
3. What do you mean by buffer solution ? Name various types of electrodes used for pH measurement. Write down Nernst equation for redox reaction.  $1 + 2 + 2$
4. What do you mean by hydrometer ? Briefly discuss the working principle of vibrating U tube Densitometer.  $1 + 4$
5. State the Beer-Lambeert's law for IR analysis. Briefly discuss the operation of Golay pneumatic cell.  $3 + 2$
6. Explain zirconia probe oxygen analyser.

### GROUP – C

#### ( Long Answer Type Questions )

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) With the functional diagram, explain the working principle of a hot wire thermal conductivity type gas analyzer.
- b) Name the gases which can be analysed by NDIR analyser. Discuss the principle of operation of an NDIR analyzer.



- c) Name the various types of IR sources used in IR Spectrometry. 6 + 1 + 6 + 2
8. a) Discuss briefly about two pole and four pole types conductivity cells.
- b) What are the different sources of error in conductivity measurement ?
- c) What is turbidity ? Name the units of it. Explain the nephelometric measurement of turbidity. 5 + 4 + (2 + 1 + 3)
9. a) Explain with the help of a functional diagram how oxygen concentration in sample gas can be determined by paramagnetic analyser.
- b) Write the basic principle of mass spectrometry. What are the different types of mass spectrometers ? Briefly discuss about any one of them. 5 + 3 + 1 + 6
10. a) How do you estimate the percentage of oxygen present in sample gas by Heat of Reaction method ?
- b) Briefly explain the electrode-less method of conductivity measurement.
- c) Briefly discuss the working principle of US densitometer. 5 + 5 + 5
11. Write short notes on any *three* of the following : 3 × 5
- a) IR Spectrometer
- b) Electrolytic hygrometer
- c) Magnetic wind type oxygen analyzer
- d) Microphone type IR detector
- e) Capillary flow based viscometer.
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