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 : $10 \times 1 = 10$

   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

a) 0 b) < 0

c) > 0 d) none of these.

v) Humidity can be measured in

a) cc b) mole

c) Vppm d) none of these.

vi) In hair hygrometer, humidity sensitive component should be

a) paper b) wood

c) animal hair d) all of these.

vii) A buffer solution is a solution that

a) retains its pH for a long time

b) cannot retain pH for long

c) has no electrolytic property

d) acts as an intermediate solution between two solution of different pH.

viii) Turbidity is a common criterion to measure

a) Water quality b) Air quality

c) Soil quality d) None of these.

ix) Zirconia probe is used for detection of

a) He b) H_2

c) N_2 d) O_2.

x) Pyroelectric detector is formed by temperature sensitive

a) resistor b) inductor

c) capacitor d) diode.

xi) In vibrating U tube densitometer, if D is density, t is time period of oscillation, then

a) $D = At + B$ b) $D = At - B$

c) $D = At^2 + B$ d) $D = At^2 - B$.

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 × 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 × 15 = 45

7. a) With the functional diagram, explain the working principle of a hot write 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.