2015

Instrumental Methods of Analysis
(AEIE 5203)

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 for the following: **10 x 1=10**

(i) Chromatography is used to:
- (a) Separate two or more compounds based on their polarities.
- (b) Separate two or more compounds based on their masses.
- (c) Separate two or more compounds based on how strongly they interact with other compounds.
- (d) More than one of the above.

(ii) If a solution conducts electricity, it is probably:
- a) an acid
- b) a base
- c) neutral
- d) it is impossible to guess.

(iii) Which is the correct order of events in the process of atomization?
- (a) nebulization - desolvation - volatilization
- (b) volatilization - desolvation - nebulization
- (c) desolvation - volatilization - nebulization
- (d) nebulization - volatilization – desolvation.

(iv) The K- and L-lines in an atomic x-ray spectrum correspond to
- (a) transitions from lower to higher energy levels
- (b) electron-electron collisions
- (c) absorption and emission of high-energy photons
- (d) transitions from upper energy levels to the innermost shell of the atom.

(v) What is Fourier Transformed in FTIR in order to obtain the spectrum?
- (a) interferogram
- (b) FID
- (c) power spectrum
- (d) digital filter.

(vi) Which lamp is used in fluorescence?
- (a) hollow cathode
- (b) D2
- (c) Xe arc
- (d) H2.

(vii) Mass spectrometers separate isotopes of different elements based on their:
(a) mass (b) electric charge
(c) mass divided by electric charge (d) none of these.

(viii) The unit of dissolved oxygen is
(a) mg/l (b) mg/dl
(c) gm/l (d) gm/dl.

(ix) In X-Ray tube , Anode metal should have
(a) Higher atomic no. and higher boiling point
(b) Higher atomic no. and lower boiling point
(c) Lower atomic no. and higher boiling point
(d) Lower atomic no. and lower boiling point.

(x) Which of the following compounds is NOT polar?
(a) ammonia (b) nitric acid
(c) methane (d) none of these.

Group – B

2. Explain with a schematic diagram the operation of a double beam UV spectrometer. Mention its advantages over a single beam instrument.

10+2=12

3.(a) With a lucid diagram describe the arrangement and working of Luminescence D.O. Probe.

(b) Write down the steps for BOD measurements. Calculate the BOD of a sample as per the data mentioned below:

Initial Sample D.O. = 8.1 mg/L
5-Day Sample D.O. = 2.1 mg/L
Vol. Of Sample in 300 mL Bottle = 60 mL

6+(3+3)=12

Group – C

4. What is HPLC? Explain with a diagram the instrumentation in HPLC. Discuss its advantages and applications.

(8+2+2)=12

5.(a) With a neat sketch, explain the principle and operation of NO_x gas analyzers.

(b) Explain with neat sketches the operational block diagrams of any two parameters in SWAS? Explain.

6+6=12

Group – D

6.(a) What is XRF? Explain the basic principle of XRF.

(b) With a neat sketch, explain the basic arrangement of EDXRF and WDXRF.

(1+2)+9=12

7.(a) Explain with a diagram the instrumentation in IR spectrophotometers.

(b) Discuss the role of monochromator in spectrophotometer. Show the vector diagrams of dipole moments in CO_2 and H_2O molecules.

6+(2+4)=12

Group – E

8. Draw the schematic diagram of a mass spectrometer and explain its principle of operation. State the advantages and disadvantages of the mass spectrophotometers.

(8+2+2)=12

9.(a) Explain with a diagram the instrumentation in Atomic emission spectrometry.

(b) Write a short note on Effluent treatment plant.

8+4=12