(vii) Force acting on electron of charge ***e***, mass ***m*** and moving with a velocity ***v*** in a direction parallel to uniform magnetic field ***H*** is

(a) Zero (b) $\frac{Hev}{r^2}$ (c) $\frac{mv^2}{r}$ (d) none of these.

(viii) Typical detector of an ultraviolet gas analyser is
(a) Photomultiplier (b) Thermocouple
(c) Thermistor (d) None of these

(ix) Absorbity of a substance in a solution for a given wavelength will vary with
(a) concentration
(b) concentration and viscosity
(c) length of the light path
(d) concentration and length of the light path

(x) The flight time for the 'Time of Flight' mass analysers is proportional to

(a) *m* (b) *1/e* (c) $\sqrt{m/e}$ (d) $\sqrt{e/m}$

Group - B

2. (a) Why SiO_2 analyser is used in SWAS? Describe a schematic arrangement for measuring the concentration of SiO_2 in water.

(b) With a neat sketch, explain the principle and operation of SO_2 gas analyzer.

6 + 6 = 12

3. (a) Explain with a schematic diagram the operation of a double beam UV spectrometer.

(b) Discuss about the sensors and light sources used in UV spectrophotometer.

6 + (3+3) = 12

Group - C

4. (a) Explain, with a diagram, the instrumentation in FTIR spectrophotometers.

(b) Discuss the role of grating in a spectrophotometer. Draw the mechanical model of a molecule formed by atoms and express the natural frequency of oscillations.

8 + (2+2) = 12

5. (a) With a neat sketch, explain the principle and operation of O_2 gas analyzer.

(b) Explain the working of a 4-electrode conductivity meter. Discuss the relative merits and demerits of 2 and 4 electrode conductivity meters.

6 + (4+2) = 12

Group - D

6. (a) What do you mean by temperature programming for gas chromatography process? Describe the operation of the Flame Ionization Detector (FID) used in gas chromatography.

(b) Describe how qualitative as well as quantitative information can be extracted from chromatogram.

(3+4)+5=12

7. (a) Draw the schematic block diagram for HPLC and describe the same. Explain the solvent programming/gradient elution process for HPLC.

(b) Discuss the operation of the dual beam type UV absorbance detector commonly used for HPLC.

(5+3) + 4 = 12

Group - E

8. (a) Describe the operation of the dual beam type instrument for atomic absorption spectroscopy. What are the advantages of the dual beam type instrument over single beam type instrument?

(b) Name two sources for atomic absorption spectroscopy. Describe the operation of ultrasonic nebulizer used for sample injection.

(5+2) + (2+3) = 12

9. (a) Explain Bragg's Law for X-ray diffraction.

(b) Describe the working of the energy–dispersive X-ray fluorescence spectrometer. State two applications of the X-ray fluorescence.

4 + (6+2) = 12

M.TECH/AEIE/2ND SEM /AEIE 5203/2016
2016

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 alternatives for the following: **10 × 1=10**

(i) IR spectrophotometer depends on _____ for its operation
(a) molecular vibration (b) electronic transition
(c) rotation motion of molecules (d) nuclear spin transition.

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

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

(iv) Blue light in the visible region has a longer wavelength than
(a) IR radiation (b) x-rays
(c) red light in the visible region (d) microwaves

(v) pH of boiler feed water should lie between
(a) 7-9 (b) 3-6 (c) 11-14 (d) none of these.

(vi) For a given column operated at a temperature T and carrier gas flow rate F, the length of time that each component spends in the gas chromatograph column is called
(a) dead time (b) retention time
(c) retarded time (d) delay time