53 (IE 505) ANIN

2014

ANALYTICAL INSTRUMENTATION

Paper : IE 505

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Discuss the principle of flame photometer with the help of a block diagram. 6

   (b) Derive the expression for Beer's Lambert law and explain its significance. 8

   (c) What is Fourier transform infrared spectroscopy (FTIR) ? Explain with the help of a diagram. 6

2. *(a)* With reference to the spectral lines of absorption, describe the principle of atomic absorption spectrophotometer. 6

(b) What do you understand by 'Sputtering'? Explain the process of sputtering in atomic absorption spectroscopy. 5

(c) Describe a method of aerosol production in atomic absorption spectroscopy. 4

(d) Draw a sketch of inductively coupled plasma torch and explain its working. 5

3. *(a)* Cite the analogy between mass spectroscopy and optical spectroscopy. Mention some applications of mass spectrometer. 5

(b) Explain the principle and working of quadrapole mass spectrometer. 7

(c) Discuss a method of generation of ion in mass spectrometer. 6

(d) Compare high pressure liquid chromatography (HPLC) with gas chromatography. 2

4. *(a)* Describe the basic principle, construction and working of a X-ray tube to generate X-rays. 8

(b) Discuss *two* important applications of X-rays. 6

(c) What do you understand by solvent programming ? How it is done in HPLC ? 6

5. *(a)* Describe the basic principle of nuclear magnetic resonance spectroscopy with relevant mathematical expressions. 6

(b) Discuss the constructional details of NMR spectrometer. 5

(c) What do you mean by 'Scintillation' ? How a scintillation counter works ? 4

(d) What are the types of particles emitted in radioactive decay ? Discuss their properties and interactions with matter. 5

6. *(a)* Explain the principle of chromatography. Classify the techniques used in chromatography. 5

(b) Explain the operation of G-M counter with a suitable diagram. 5

(c) Distinguish between a packed column and a capillary column used in gas chromatography. 4

(d) Discuss the working of a flame ionization detector with a neat diagram. 6

7. (a) Explain the construction and working of a infrared gas analyzer. 5

(b) With the help of a diagram, describe the operation of paramagnetic oxygen analyzer. 5

(c) Describe the basic principle of pH measurement. 4

(d) What is the function of calomel electrode in pH measurement ? Discuss its construction and working. 6

8. (a) Write short notes on the following : $7 \times 2 = 14$

(i) Pumps used in HPLC.

(ii) Methods used for detection of sulphur dioxide.

(b) Explain the principle and working of selective ion electrode. Mention some important applications. 6
