Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 21015

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Seventh Semester

Biomedical Engineering

OBT 751 – ANALYTICAL METHODS AND INSTRUMENTATION

(Common to : Electrical and Electronics Engineering / Electronics and Instrumentation Engineering / Instrumentation and Control Engineering / Medical Electronics)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name two wavelength selectors.
2. Name two uv sources.
3. In an absorption experiment the initial absorbance is X, the concentration is halved and the path length is also halved. What is the new value of absorbance in terms of X?
4. How many modes of vibration does O_2 have? Is it IR active?
5. The Deutirium nucleus has a spin of 1(l = 1). How many energy levels will it have on application of a magnetic field?
6. What does the *x*-axis denote in a mass spectrum?
7. What is the stationary phase used in reverse phase chromatography?
8. Why is O_2 not used as a carrier gas in GC?
9. What is the expression for Nernst equation ?
10. Brief about the tip used in AFM?

PART B — (5 × 13 = 65 marks)

11. (a) Draw a diagram of a typical optical instrument and explain the parts of the instrument and their functions.

Or

(b) What are the hardware and software methods commonly used to enhance the S/N ratio?

12. (a) Draw and explain the working of a double beam spectrophotometer? What are its advantages and limitations?

Or

(b) Draw and explain the working of FT-IR instrument? Distinguish between IR and Raman spectroscopy.

13. (a) Draw and explain the working of an NMR spectrometer. Explain the uses of ^{1}HNMR and ^{13}CNMR with suitable examples.

Or

(b) Draw and explain the working of an Electorspray Mass spectrometer? What are its advantages and disadvantages?

14. (a) Draw and explain the working of a typical HPLC machine with a neat diagram. Explain their uses.

Or

(b) Draw and explain the working of a Gas Chromatograph? Discuss the various detectors used.

15. (a) Draw and explain the working of a Scanning Tunneling Microscope. How is it different from scanning electron microscopy?

Or

(b) Draw and explain the working mechanism of an Atomic Force Microscope? What are its types? Explain their uses.

PART C — (1 × 15 = 15 marks)

16. (a) (i) What is the relationship between distance, incident angle and wavelength on incidence of Light on a diffraction grating. Explain. (5)

(ii) How many vibrational mode does CO_2 have? Sketch which are vibrationally active and which are Raman active. (5)

(iii) What are the causes of band broadening in Chromatography? How can it be reduced? (5)

Or

(b) (i) Sketch the high resolution spectrum of ^{1}HNMR of CH_3CH_2OH. (8)

(ii) How can Size exclusion chromatography be used for finding the molecular weights of macromolecules. (5)

(iii) The E_0 of a electrochemical cell is 1.0 V. What is the value of delta G? (2)