

10. (a) (i) Give an account of FT-IR and FT-Raman spectroscopy and their applications. (10)
- (ii) Discuss the role of computer averaging in spectroscopic techniques. (5)

Or

- (b) (i) Explain the principle of FT spectroscopy. Discuss various types of FT spectrographs. (6)
- (ii) What are the requirements of solvents used in UV-visible spectroscopy? (4)
- (iii) Explain the following :
- (1) Photometric precision
- (2) Difference spectroscopy. (5)

Paper I — RESEARCH METHODOLOGY  
(Held in April 2010)

Time : Three hours

Maximum : 100 marks

PART A — (5 × 5 = 25 marks)

Answer ALL questions.

1. Distinguish between basic research and applied research.
2. Explain the terms histogram, dispersion and range.
3. What are the postulates of a group?
4. TLC is superior over other chromatographic techniques. Explain.
5. Explain the factors affecting photometric accuracy.

PART B — (5 × 15 = 75 marks)

Answer ALL questions.

6. (a) (i) What is an optimum data? How are the collected data analysed? (8)
- (ii) Explain the following :
  - (1) Literature survey
  - (2) Bibliography. (3 + 4)

Or

- (b) (i) Discuss various components of a research paper. (10)
- (ii) Discuss the importance of scientific seminars in research. (5)

7. (a) (i) Give an account of systematic errors. How are they minimised or eliminated? (10)
- (ii) Write briefly on Gaussian curve of errors. (5)

Or

- (b) (i) Explain the methods followed for the rejection of data. (6)
- (ii) Obtain equations for variance and standard deviation of combination of components. (4)
- (iii) Write a note on polynomial regression. (5)

8. (a) (i) Taking  $\text{CH}_3\text{Cl}$  molecule as an example, explain how the fundamental vibrations are distributed among the symmetry species of point groups. (6)
- (ii) Discuss the matrix representation of point groups. (6)

- (iii) Which of the following molecules/ions have
- (1) A centre of inversion and
- (2) an  $S_4$  axis. (3)

- [ (I)  $\text{CO}_2$  (II)  $\text{C}_2\text{H}_2$  ]  
 [ (III)  $\text{BF}_3$  (IV)  $\text{SO}_4^{2-}$  ]

Or

- (b) (i) Discuss the solid state effects on molecular symmetry. (5)
- (ii) Write the character table for  $C_{3v}$  point group and explain its format. (5)
- (iii) Explain the distribution of fundamentals among the symmetry species with an example. (5)

9. (a) (i) Explain the principle and experimental details of column chromatography. (12)
- (ii) Write briefly on the pumping systems and detector systems used in HPLC. (3)

Or

- (b) (i) Explain the principle of ion exchange chromatography. (5)
- (ii) Discuss the types of ion exchangers used. (5)
- (iii) List the applications of GC. (5)

(6 pages)

**5937/Z12**

**NOVEMBER 2009**

Paper II— COURSE WORK — I  
(Held in April 2010)

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Time : Three hours

Maximum : 100 marks

**PART A — (5 × 5 = 25 marks)**

Answer ALL questions.

1. Discuss the electromagnetic enhancement mechanism of SERS.
2. Explain various techniques for the characterization of nanomaterials and nanostructures.
3. Explain transform with two examples.
4. What are the advantages of using Technetium in radio – pharmaceuticals?
5. Discuss the use of clay materials in green chemistry with two examples.

**PART B — (5 × 15 = 75 marks)**

Answer ALL questions.

6. (a) (i) What is resonance Raman effect? Explain its principle and theory. (7)  
(ii) Discuss inverse Raman effect and its instrumentation. (8)

Or

(b) Write notes on :

- (i) NMR imaging. (7)
  - (ii) Reflection absorption infra-red spectroscopy. (8)
7. (a) (i) How are nanoparticles prepared by evaporation and sputtering methods? Mention the differences between these two methods. (11)  
(ii) How are Rh and Ni nanoparticles prepared? (4)

Or

