

**UKA TARSADIA UNIVERSITY**  
**M. Pharm. (Pharmaceutical Analysis) (1<sup>st</sup> Semester)**  
**040060103: Advanced Spectroscopic Techniques**

**Duration: 3 hours**

**Maximum marks: 70**

**Instructions:**

1. Attempt all questions
2. Write each section in a separate answer book.
3. Make suitable assumptions wherever necessary.
4. Figures to the right indicate full marks allocated to that question.
5. Draw diagrams/figures wherever necessary.

**SECTION-1**

**Q.1] (a) Answer the following: [7 x 1 = 7]**

- 1) What is Chemi luminescence?
- 2) Name the detectors used in Photo acoustic spectroscopy.
- 3) Give full form of SERS.
- 4) What do you mean by lasing medium?
- 5) What is 2D NMR?
- 6) What is a virtual state?
- 7) Enlist the components of a Raman spectrometer.

**(b) Attempt any four: [4 x 2 = 8]**

- 1) Which unique features make LASER a highly useful source in analytical instrumentation?
- 2) What is stoke's and antistoke's shift?
- 3) What is resonance Raman spectroscopy?
- 4) What do you mean by three and four level laser systems?
- 5) Give benefits of 2D NMR.
- 6) Define enantiotopic protons and diastereotopic protons.

**Q.2] (a) Describe the principle of COSY with suitable example. [5]**

**OR**

**(a) Define chemical equivalence and magnetic equivalence. Differentiate between first order and non-first order NMR spectra. [5]**

**(b) Describe the pulse sequence followed in HETCOR. [5]**

**OR**

**(b) Describe the instrumentation and applications of Chemi luminescence. [5]**

**Q.3] Attempt any two**

**[2 x 5 = 10]**

- 1) Explain principle of photo acoustic spectroscopy and state its applications.
- 2) Enumerate the types of lasers used in analytical chemistry. Explain the working of Semi conductor diode laser with suitable diagram.
- 3) Describe homotopic and nonhomotopic groups with suitable examples.

**SECTION-2**

**Q.4] (a) Answer the following:**

**[7 x 1 = 7]**

- 1) Name the radiation source in ESR spectroscopy.
- 2) What is the value of natural abundance of  $^{13}\text{C}$ ?
- 3) Name the reference compound used in ESR spectroscopy.
- 4) What do you mean by activation method?
- 5) What is hyperfine splitting?
- 6) Predict the CMR number of signals for Methyl acetate.
- 7) Name the sources of neutrons employed in neutron activation method.

**(b) Attempt any four:**

**[4 x 2 = 8]**

- 1) Explain the principle of ESR spectroscopy.
- 2) What do you mean by slow and fast neutrons?
- 3) What is deuterium substitution?
- 4) Peak intensity of quaternary carbon is less as compared to non-substituted alkane in CMR. Explain.
- 5) The resonances of  $^{13}\text{C}$  nuclei are weaker and more difficult to observe than proton resonances. Give reason.
- 6) Differentiate between alpha and beta decay.

**Q.5]**

**(a) Write note on ENDOR and ELDOR techniques.**

**[5]**

**OR**

**(a) What is INADEQUATE? Explain significance of INADEQUATE in  $^{13}\text{C}$  NMR with suitable example.**

**[5]**

**(b) Write note on neutron activation methods.**

**[5]**

**OR**

**(b) Describe the factors affecting chemical shift in  $^{13}\text{C}$ -NMR.**

**[5]**

**Q.6] Attempt any two**

**[2 x 5 = 10]**

- 1) Describe instrumentation and applications of ESR spectroscopy.
- 2) Write note on Positron Emission Tomography.
- 3) Describe proton decoupled and off resonance technique used in CMR.