

M.SC.(Phy.) Semester - 4 (CBCS) Examination**April/May-2023 (NEW COURSE)****Experimental Techniques with interdisciplinary applications (Core)****Time: 2:30 Hours****Marks: 70****Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate marks.

Q – 1: Answer any SEVEN:**14**

1. Write the two units of gamma ray exposure.
2. Define: Absorbed dose.
3. Write the principle of production of X-rays.
4. What is Bremsstrahlung?
5. Mention the types of X-ray spectra.
6. Differentiate the nuclei based on they possess zero spin, integral spin and fractional value of spin: $^{23}\text{Na}_{11}$, $^2\text{H}_1$, $^4\text{He}_2$, $^{16}\text{O}_8$, $^{10}\text{B}_5$ and $^{17}\text{O}_8$.
7. What do you mean by stable and unstable paramagnetic substances?
8. Explain with one example: Mass spectrometer can distinguish different isotopes of a given element.
9. For a nonlinear molecule made up of N atoms, what will be the vibrational degrees of freedom? Give the reason of your answer.
10. What do you mean by Doppler broadening in Mossbauer spectroscopy?

Q – 2: Write any TWO:**14**

- (A) Discuss in detail: Neutron sources.
- (B) Discuss in detail: Semiconductor detector.
- (C) Describe X-Ray Fluorescence spectrometer (XFS) with diagram.

Q – 3: Answer the following questions: ALL ARE COMPULSORY**14**

- (A) Write the principle of X-ray absorption technique. Discuss the non- dispersive X-ray absorption meter..
- (B) State the principle of production of X-rays. Discuss various parts that are needed in production of X-rays.

OR**Q – 3: Answer the following questions: ALL ARE COMPULSORY****14**

- (A) Discuss the hyperfine splitting of ESR spectrum with example of H-atom and methyl radical (CH_3).
- (B) Discuss the various modes of vibrations of atoms in molecule.

Q – 4: Write any TWO:**14**

- (A) What is spin-spin coupling in NMR spectroscopy? With necessary examples, explain the splitting of the lines of NMR spectrum.
- (B) Discuss the theory of mass spectrometer.
- (C) Discuss the Quadrupole splitting and magnetic hyperfine splitting of the energy levels of the nucleus.

Q – 5: Write notes on any TWO:**14**

- (1) Shielding effect in NMR spectroscopy.
- (2) Essential components of IR spectrophotometer.
- (3) Isomer shift in Mossbauer Spectroscopy.
- (4) Mossbauer spectrometer.
