

## Ph.D Course Work Examinations, July-2023

## PHYSICS

## Course-IV: Fluorescence Spectroscopy

[Time: 3Hours]

[Max. Marks: 70]

- Instructions:** 1) Answer all the questions.  
 2) Part A: Questions 1-8 carries 15 marks each.  
 3) Part B: Questions 9-12 carries 5 marks each

**PART A**

- 1 a) State and explain Frank-Condon Principle. 5+10  
 b) What is a rigid and non-rigid rotator? Explain the diatomic molecule as a simple harmonic oscillator.
- OR
- 2 a) Explain in detail the various molecular transitions using the Jablonski diagram. 10+5  
 b) Write a note on long-lifetime probes.
- 3 a) Mention the characteristics of an ideal spectrofluorometer. 5+10  
 b) Discuss in detail different light sources and optical filters used in spectrofluorometer.
- OR
- 4 a) Give an account of quantum yield standards and their importance in fluorescence spectroscopy. 5+10  
 b) Discuss the principle, construction and working of the Time-correlated single-photon counting (TCSPC) instrument.
- 5 a) Derive an expression for the Lippert equation based on solvent effects. 10+5  
 b) Discuss the effect of temperature on the emission spectra of molecules using a suitable example.
- OR
- 6 a) Briefly explain the effect of shear stress on membrane viscosity. 5+5+5  
 b) Outline the interaction of calcium calmodulin exposed to a hydrophobic surface.  
 c) Write a note on advanced solvent-sensitive probes.
- 7 a) Discuss the combined dynamic and static quenching process using Stern-Volmer plots. 5+10  
 b) Discuss any one application of quenching to proteins.
- OR
- 8 a) Discuss the theory of resonance energy transfer for a donor-acceptor pair and obtain the expression for Förster distance and energy transfer efficiency. 10+5  
 b) Write a brief note on distance measurements in  $\alpha$ -Helical Melittin using RET.

**PART B**

- 9 Write the difference between steady-state and time-resolved fluorescence methods. 5
- OR
- 10 Explain the calibration of monochromators in a spectrofluorometer. 5  
 11 Discuss the effects of solvent polarity on the fluorescence of the molecule. 5
- OR
- 12 Write a note on Homotransfer and Heterotransfer. 5

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