

## CH-439 Photochemistry

**Credit Hours:** (3-0)

**Pre-requisite:** Nil

### **Course Objectives:**

This course aims to provide a thorough understanding of the fundamental principles and laws of photochemistry, including quantum yields and energy transfer processes. Students will explore key photochemical reactions and mechanisms such as fluorescence, phosphorescence, and laser action. Additionally, the course will highlight practical applications of photochemistry in areas like photo stabilization, chemiluminescence, and photochromism, equipping students with both theoretical knowledge and real-world insights.

### **Course Contents:**

Photochemistry: Principles of photochemistry, laws of photochemistry, Einstein's law of photochemical equivalence, rates of intramolecular processes, chemical reactions and quantum yields with examples, energy transfer in photochemical reaction, quantum yield of emission process radiation and nonradiation process, kinetics and quantum yields of radiative and nonradiative process (fluorescence, phosphorescence, inter-system crossing, internal conversion, quenching) and Stern-Volmer reactions, photosensitized reactions. Resonance fluorescence, Sensitized fluorescence, Classification of fluorescence and difference between fluorescence and phosphorescence. Laser, absorption, spontaneous emission, and stimulated emission. Meta stable state, laser action, kind of laser and uses of laser.

#### Photochemical Reactions

- a. Dimerization of Anthracene in solution.
- b. Hydrogen - Bromine Reaction.
- c. Hydrogen - Chlorine Reaction.
- d. Decomposition of Hydrogen Iodide

#### Introduction to Applications of Photochemistry

- a. Photo stabilization and degradations.
- b. Photochromism.
- c. Chemiluminescence.
- d. Optical Brighteners.

**Course Outcomes:**

By the end of this course, students will be able to:

Explain the fundamental principles and laws governing photochemical reactions and processes.

Analyze and calculate quantum yields and understand the kinetics of radiative and non-radiative processes like fluorescence and phosphorescence.

Describe and interpret key photochemical reactions such as dimerization of anthracene and hydrogen-halide reactions.

Apply photochemical concepts to real-world applications including photo stabilization, chemiluminescence, and the functioning of lasers.

**Recommended Books:**

- a. Dunkin, I., *Photochemistry*, Vol. 36, RSC Publishing, (2007).
- b. Photochemistry of small molecules by D.R. Arnold, N.C. Baird
- c. Principles of Photochemistry by J.A. Barltrop and J.D. Coyle.
- d. Text Book of Physical Chemistry by S.Glasstone.