Semester	JAN 2022
Open to semester	8,12,14,22
Course code	**CHM433/CH6274**
Course title	**Photochemistry and Photophysics**
Credits	3 /4
Course Coordinator & participating faculty (if any)	Pramod Pillai
Nature of Course	Lectures
Pre-requisites	Fundamentals of Molecular Spectroscopy (CHM323)
Objectives (goals, type of students for whom useful, outcome etc)	Objectives: Interaction of light and matter is an important phenomenon, which leads to a variety of exciting applications in the areas of both medical and energy research. The main objective of this course is to provide a basic understanding on various photophysical processes occurring upon the exposure of light by a material. Also, the course will provide a brief summary of various instrumentation techniques that are required to study such light-matter interactions. Further, the course will provide a brief overview of various real time practical applications where photophysics plays a crucial role in our day to day life. The applications will cover topics from both medical and energy areas. The course will also include representative demonstrations of various light induced processes in artificial materials. The knowledge gained from this course will be useful to students from multiple disciplines and sub-disciplines of science, especially from chemistry and physics. Outcomes: The students will attain both basic and advanced knowledge on various chemical and physical processes occurring in materials upon exposure to sunlight, which forms the base for solar harvesting. The students will get familiarized with different ways of converting solar energy to other forms of energies. This course is expected to stimulate the thought process of students with respect to different ways of using solar energy.
Course contents (details of topics /sections with no. of lectures for each)	1. Fundamental Concepts (17 Lectures): Absorption of light and excited state deactivation pathways (Jablonski Diagram), Photochemistry and photophysics, laws of photochemistry,

	Primary processes in photochemical reactions, Fluorescence, Delayed fluorescence and Phosphorescence, Concept of quantum yield, Lifetime, Anisotropy, Quenching and Sensitization phenomena, Bimolecular quenching, Stern-Volmer equation, Static versus Dynamic quenching, Electron transfer reaction & Marcus theory, Excited state proton transfer, Foster Resonance Energy Transfer (Coulombic), Dexter (Exchange) mechanisms and examples, Photoisomerisation, Dimerization reactions, Excimer and Exciplex, Diffusion controlled rate constants, Photochemical equilibrium. 2. Natural and Technological Applications (7 lectures): Natural and artificial photosynthesis, Vision, Photochromism, Photocatalysis, Photochemical damage in living systems and recovery, Photodynamic therapy, Aggregation-Induced Emission (AIE), Light powered molecular devices and machines (molecular memories, sensors, rotary motors, logic gates, Encoding and Decoding, Switches, etc.). 3. Techniques and Instrumentation (4 Lectures): Steady-state absorption and emission spectroscopy (Emission and excitation spectra, Absolute and relative quantum yield measurements), Time-resolved absorption and emission spectroscopy (techniques used in measuring lifetime using single photon counting and fluorescence up-conversion).
Evaluation /assessment	End-Sem Examination-35% Mid-Sem Examination-35% Others-Continuous evaluation (Quizzes, assignments, presentation, etc.) = 30% %
Suggested readings (with full list of authors, publisher, year, edn etc.)	1. Photochemistry and Photophysics: Concepts, Research, Applications by Vincenzo Balzani, Paola Ceroni, Alberto Juris. 2. Modern Molecular Photochemistry by Nicholas J. Turro. 3. Principles of Fluorescence Spectroscopy by J. R. Lakowicz. 4. Fundamentals of Photochemistry by K. K. Rohatgi Mukherjee. 5. Handbook of Photochemistry by Marco Montalti, Alberto Credi, Luca Prodi, M. Teresa Gandolfi. 6. Physical Chemistry by Ira. N. Levine.