

Department of Chemical Sciences

Graduate Course on

Optical Spectroscopy and Microscopy

Background expected: Quantum Mechanics, Mathematical Methods

Syllabus

Part A.

- 1) Introduction: Molecular Spectroscopy: What it can tell us, limitations; Microscopy: What it can tell us, limitations
- 2) Light matter interactions: perturbation theory, second quantization, Feynman diagrams
- 3) Two level systems: Density matrix formalism, Concepts of weak/strong perturbation, dephasing and Coherence.
- 4) Molecular spectroscopy: Born Oppenheimer approximation, motion on potential energy surfaces, non-radiative decay
- 5) Brief introduction to UV/VIS, Vibrational, Raman and Circular Dichroism spectroscopy
- 6) Fluorescence spectroscopy, linear and multiphoton
- 7) Fluorescence lifetime, TCSPC technique, Quenching, , FRET, Anisotropy

Part B.

- 8) Lasers and amplifiers, non-linear optics
- 9) Ultrafast spectroscopy
- 10) Properties of light, Maxwell's equations, fiber optics
- 11) Diffraction theory
- 12) Microscopy: Theory of Image formation, Confocal and multiphoton microscopy
- 13) Super-resolution microscopy
- 14) Single molecule microscopy and spectroscopy
- 15) Fluorescence correlation spectroscopy
- 16) Surface enhanced Raman spectroscopy

Venue: AG80

Hours: Mon, Wed, Fri 9:30 am – 11:00 am

Instructor: Prof. Sudipta Maiti (Email: maiti@tifr.res.in)

First lecture on Jan 17, 2020 (Friday)

Final Exam: Friday, May 29, 2020