

DSE-II (i): Lasers and Laser Applications

Theory: 3 hours per week (3 Credits)

Theory Marks: 70

Internal Marks: 30

COURSE CONTENTS: DSE-II (i): Lasers and Laser Applications

Unit I	Spontaneous emission, Stimulated emission, Population inversion, Fabry Perot etalon, Stable two mirror optical resonators, Longitudinal and transverse modes of laser cavity, Mode selection, Gain in a regenerative laser cavity.	8
Unit II	Two level laser systems, threshold for three and four level laser systems, mode locking, pulse shortening- pico second and femto second operation, spectral narrowing and stabilization.	8
Unit III	Nitrogen laser, Carbon dioxide laser, Excimer laser, Dye laser, Ruby laser, Nd-YAG laser, Diode – pumped solid state lasers, Semiconductor lasers, High power laser systems.	8
Unit IV	Laser induced fluorescence, Raman scattering and its applications, Non-linear interaction of light with matter.	7
Unit V	Laser induced multi-photon processes and their applications. Propagation of light in a medium with variable refractive index, Optical fibres.	7
Unit VI	Light wave communication, Qualitative treatment of medical and engineering applications of lasers, Material processing.	7

REFERENCE BOOKS:

1. Introduction to Laser Physics: Koichi Shimoda, Springer
2. Introduction to Laser Physics: B. A. Lengyl, John Wiley & Sons Inc
3. An Introduction to Lasers (Theory and Applications): M. N. Avdahanulu and P S Hemne, S. Chand
4. Principles of Lasers: Orazio Svelto, Springer
5. Introduction to Optical Electronics: Amnon Yariv, Holt McDougal
6. Laser Spectroscopy: Basic Concepts and Instrumentation: Wolfgang Demtröder, Springer
7. Nonlinear laser spectroscopy: V. S. Letokhov and V. P. Chebotayev, Springer
8. Laser Fundamentals: William T. Silfvast, Cambridge University Press

Equivalent MOOC on SWAYAM:

1. <https://nptel.ac.in/courses/104104085>
2. <https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/laser-fundamentals-i/>
- 3.

Any pertinent media (recorded lectures, YouTube, etc.) if relevant:

