

Course Title: **Principles of Lasers and Detectors**

Course Number: **PHY690P/PSE 602**

Units: **3-0-0-0-9**

Pre-requisite: **None**

Level: **PG**

**Course Description:**

This course provides an introduction to the fundamental principles governing the operation and design of coherent light sources and detection tools.

**Course Topics:**

Introduction to light sources, Lasers, principle of lasing

Optical cavities, longitudinal, transverse modes, Stability

Interaction of radiation with matter, Spontaneous emission

Absorption and stimulated emission, line broadening mechanisms

Population inversion, absorption and gain coefficients

Pumping schemes (Rate equation based Lasing model)

Three- and four- level lasers

CW and pulsed lasers, Q-switching and mode-locking

Detection of optical radiation:

photomultiplier tubes, semiconductor photodiodes, avalanche photodiodes, Single photon

detectors, dark current, thermal noise, shot noise

Measurement systems: Spectroscopy (Spectral and Temporal measurement systems),

CCD, monochromator, pulse width measurement

**References:**

1. Laser Physics, Peter W. Milonni and Joseph H. Eberly, Wiley, 2nd edition, 2010

2. Lasers, Anthony E. Siegman, University Science Books; 1st edition, 1986

3. Laser Electronics, Joseph T. Verdeyen, Prentice Hall; 3rd edition, 1995

4. Laser spectroscopy, W. Demtroder, 3rd edition, 2004

5. Lasers, Theory and Applications, K. Thyagarajan and A.K. Ghatak, Macmillan India Ltd., 2010

6. Principles of Lasers, O. Svelto and D. C. Hanna, 5th edition, 2010