

COURSE/UNIT STUDY GUIDE

SPH 618: Laser Applications

Lecturers:

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Introduction to the course unit

The word *LASER* is an acronym for “*Light Amplification by Stimulated Emission of Radiation*”. As the name suggests, it is a light that is produced through the process of stimulation of radiation. The resulting light is highly monochromatic, brighter/intense, coherent, highly directional than any light from other sources such as incandescent lamps, sun, fluorescence tubes, candles etc. Since its discovery, this special light has found a lot of applications in industry, medicine, military, communication and scientific investigations. This course/unit intends at highlighting some of these applications.

Aims: The course aims at making the student appreciate the significance of lasers in industry, medicine, communication and scientific research.

Objectives: At the end of this course unit, students should be able to:

1. Describe the properties of laser radiation.
2. Describe how lasers can be used in measurement of distance.
3. Discuss the principle of LADAR and LIDAR.
4. Explain the principle of Raman spectroscopy and LIBS.
5. Explain how lasers are used in optical communication.

SPH 618: Course Outline

1. Review of properties of laser radiation: line width, frequency stabilization, divergence, coherence, brightness, conversion of laser radiation (Q-switching, mode locking and frequency doubling).
2. Metrological and scientific applications: optical alignment, measurement of distance, interferometry, surface topography and optical component testing, beam-modulation telemetry. Pulse-echo techniques: LADAR and LIDAR, LDV(Laser Doppler velocimetry); Laser gyroscopes. Raman spectroscopy and LIBS (Laser Induced Break-down Spectroscopy), Tunable Diode Laser Spectroscopy.
3. Industrial, medical and military applications of lasers: beam focusing and transport, material processing applications, laser-induced nuclear fusion, laser weapons; Holography; Optical information transmission and storage.
4. Optical communication, optical fiber, optical emitters and detectors; Integrated optics; Laser printing; Optical disc systems- audio CD, CD-ROM, DVD.

Assessment: Assessment of the course shall comprise two C.A.Ts giving a total of 30 mks and Exam marked out of 70 mks.

References

1. Richard S. Quimby, Photonics and Lasers: An Introduction, John Wiley Sons, Inc., (2006).
2. Orazio Svelto and David C. Hanna, Principles of Lasers, 4th edition, Spinger,(1998).
3. Willium T. Silfvast, Laser Fundamentals, 2nd edition, Cambridge University Press, (2004).
4. Govind P. Agrawal , Fiber-Optic Communication Systems , 3rd edition, John Wiley & Sons,

- Inc., (2002).
5. Ewen Smith and Geoffrey Dent , Modern Raman Spectroscopy – A Practical Approach , John Wiley & Sons Ltd , (2005).