This course introduces the students to the field of Semiconductor Optoelectronics, which deals with the physics and technology of semiconductor optoelectronic devices such as light emitting diodes, laser diodes and photodiodes, which are becoming important components in consumer optoelectronics, IT and communication devices, and in industrial instrumentation. Assuming a general science/engineering undergraduate level background, the course begins with a recap of essential (to this course) semiconductor physics, followed by the study of interaction of photons with electrons and holes in a semiconductor, leading to the realization of semiconductor photon amplifiers, sources, modulators, and detectors. A variety of designs and configurations of these devices have been emerging with application-specific characteristics. The course is ‘applied’ in nature, and could be offered at the level of B.E/B.Tech IIIrd/ IVth Year, M.Sc IInd/ M.Tech. I Year.

ABOUT INSTRUCTOR:
M. R. Shenoy received the M. Sc. in Physics in 1979 from Mysore University and the PhD in the field of Fiber and Integrated Optics from IIT Delhi in 1987. He joined the faculty of IIT Delhi in 1988, where he is currently Professor in the Department of Physics. Dr. Shenoy was a Visiting Scientist with the Department of Electrical and Electronic Engineering, University of Glasgow, Glasgow, U.K., in 1990 for 10 months, and on short-duration visits at the University of Nice – Sophia Antipolis, Nice, France, in 1992, 1997, 2006 and 2008 for collaborative research on Integrated Optical Devices. He has authored/co-authored a number of research papers and book chapters, and has supervised a large number of student projects at the B.Tech, M.Sc. M.Tech and Ph.D. levels. He is a co-editor of the book Fiber Optics Through Experiments (Viva Publications, New Delhi, 1994, 2008).

COURSE PLAN:
Week 01: Introduction, Energy bands in solids, Density of states
Week 02: Occupation probability and Carrier concentration, Quasi Fermi levels
Week 03: Semiconductor optoelectronic materials and Heterostructures
Week 04: Heterostructure p-n junctions, Schottky junctions, Ohmic contacts
Week 05: Interaction of photons with electrons and holes in a semiconductor
Week 06: Amplification by stimulated emission, The semiconductor laser amplifier
Week 07: Absorption in semiconductors and quantum wells, Electro-absorption modulator
Week 08: Injection electroluminescence, Light emitting diode and their characteristics
Week 09: Semiconductor laser: Device structure and characteristics
Week 10: Single frequency lasers, VCSEL and Quantum well lasers
Week 11: Semiconductor photodetectors, General characteristics
Week 12: Photodiodes: PIN diode and APD. Photonic Integrated Circuits

INDUSTRIES APPLICABLE TO:
Companies and R&D Laboratories working on Laser Applications, Optoelectronic and Optical Communication are expected to value this course.