Photonics (PLT)

Photonics and Laser Technology (PLT) Courses

PLT 1002 [0.5 credit]
Trends in Photonics
Survey of the history and future of photonics. Photonics benefits and impact on technology and society. Emerging applications of photonics in industry and commercial products. The forces (business, social, political, economic, technical, and educational) that influence the development, adoption and success or failure of technologies.
Prerequisite(s): restricted to students in the B.I.T. degree program.
Lectures one hour a week, tutorial/laboratory two hours a week.

PLT 1003 [0.5 credit]
Optics/Optical Fibers I (Principles)
Principles of optics, optical fiber, waveguides and hands-on experience with optical components. Optical fiber manufacturing and variety of industrial applications. Topics covered include: optical sources, detectors, fiber modes and mode-coupling, couplers, multiplexers, optical amplifiers, physical layer of optical networks, dispersion and nonlinear effects management.
Prerequisite(s): restricted to students in the B.I.T. degree program.
Lectures / laboratory or tutorial four hours a week.

PLT 1005 [0.5 credit]
Introduction to Optics
Physics of waves, optics and light propagation through lectures and lab experiments. Geometrical optics, refraction and reflection, interference, diffraction and polarization, thin lens equation, laser beams, Michelson interferometer, birefringence, and Abbe theory of imaging. Electromagnetic spectrum, quantum nature of light, photons, and photoelectric effect.
Prerequisite(s): BIT 1203, restricted to students in the B.I.T. degree program.
Lectures / laboratory or tutorial five hours a week.

PLT 1006 [0.5 credit]
Introduction to Automation and Simulation
Introduction to basic programming in both the Matlab and Labview environments. Program development, basic structures (loops, control structures), I/O, data visualization and graphing will be covered. Students will learn to use Labview to develop basic applications and model simple physical systems with Matlab.
Prerequisite(s): restricted to students in the B.I.T. degree program.
Lectures two hour a week, tutorial/laboratory three hours a week.

PLT 1007 [0.5 credit]
Assembly and Machine Language
Structured approach to assembly language programming. Topics include data and address registers, data and address busses, condition code register and stack pointers, machine code format, instruction sizes, operand encoding, translation of source code into machine language, and how the processor executes instructions. Also listed as NET 1004.
Prerequisite(s): Restricted to students in the B.I.T. degree program.
Lectures three hours a week, tutorial/laboratory one hour a week.

PLT 2001 [0.5 credit]
Fundamentals of Light Sources
Introduction to incoherent light sources and lasers. Lasers operation, energy levels, quantum mechanics basics. Pumping/excitation, population inversion, laser cavity design, gain and loss, and characteristics of laser emission. An extensive lab manual of relevant experiments, variety of lasers, spectrometers, and detection equipment will be used.
Prerequisite(s): BIT 1201. Restricted to students in the BIT degree program.
Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 2002 [0.5 credit]
Fiber Optics Communications I
Fiber-laser implementation and optical networks, topologies, OSI, SONET/SDH, synchronous payload envelope, virtual tributaries, optimized mapping techniques, and optical carriers (OC-n/STM-m). Extensive lab manual and hands-on experience using state-of-the-art Optophotonics Lab to work on OAM&P, facility/equipment, synchronization, bandwidth management, and performance monitoring and other functionalities.
Prerequisite(s): PLT 2000.
Lectures two hours a week, tutorial/laboratory three hours a week.

PLT 2003 [0.5 credit]
Laser Systems
Laser theory, devices and systems. Safety procedures, laser power supplies, and laser system applications. Solid state, gas, and other types of lasers. Basic material processing, micro machining, bio/medical, and military applications will be covered. Hands-on experience with advanced laser equipment in lab.
Prerequisite(s): PLT 2001.
Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 2005 [0.5 credit]
Circuits and Signals
Students learn properties of electricity and measurement techniques. Topics covered include RMS, average, applied, peak-to-peak and instantaneous values. Lab experiments deal with RC and RL circuits and LC filters. RLC circuits, and series and parallel resonance are also covered.
Prerequisite(s): BIT 1204 or PHYS 1004 or PHYS 1002
Restricted to students in the BIT degree program.
Lectures two hours a week, laboratory and problem analysis three hours a week.

PLT 2006 [0.5 credit]
Semiconductors
Fundamentals of logic circuitry in digital systems are studied including basic logic gates, Boolean algebra, signal decoding, logic circuit design, flip-flop circuits, timers and counters. The proper use of semi-conductor components is demonstrated through the use of laboratory experiments.
Prerequisite(s): PLT 2005. Restricted to students in the B.I.T. degree program.
Lectures two hours a week, laboratory and problem analysis three hours a week.

PLT 2008 [0.5 credit]
Manufacturing Photonics Components
Manufacturing techniques and methods used to produce photonics components and devices/systems. Micro assembly, adhesives, optical tests and measurement, lean manufacturing and quality control standards (Telcordia). Laboratory exposure to optical component production processes: grinding, polishing, coating, mounting, tolerance and accuracy.
Precludes additional credit for PLT 1004 (no longer offered).
Prerequisite(s): PLT 1002. Restricted to students in the B.I.T. degree program.
Lectures / laboratory or tutorial four hours a week.

PLT 3000 [0.5 credit]
Fiber Optics Communications II
Operation, management and maintenance of metro/long haul optical network elements and systems. Hands-on skills using GUI, Transaction Language One (TL1), optical network management to perform line and path protection, alarm provisioning, security and data communications, optical network backup and restore, load upgrade and installation management.
Prerequisite(s): PLT 2002.
Lectures two hours a week, tutorial/laboratory three hours a week.

PLT 3001 [0.5 credit]
Photonics Manufacturing Systems
Laser based manufacturing, measurement and control systems, further applications of laser machining, welding, emphasizing industrial real world systems. Extensive hands on laser lab experiments, measurement jigs, scanners, swept wave systems (SWS), motion stages, optics, wavelength measuring, pulse detection, oscilloscopes, digital spectrometers.
Prerequisite(s): PLT 3011.
Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 3002 [0.5 credit]
Real-time Systems
Principles of event-driven systems, review of computer organization; parallel and serial interfaces; programmable timer; I/O methods; polling and interrupts. Real-time kernels. Critical design consideration: concurrency, dead lock, synchronization. Maintaining and improving system performance. Programming exercises in low and high level languages.
Prerequisite(s): BIT 2400.
Lectures three hours a week, tutorial/Laboratory two hours a week.

PLT 3003 [0.5 credit]
Electro Magnetics
Review of basic vector calculus followed by an introduction to electrostatics and magnetostatics. Maxwell's equations and EM wave solutions. EM waves in dielectrics media, reflection, refraction,Fresnel relations and Brewster angle. Introduction to guided waves emphasizing slab waveguides.
Prerequisite(s): (BIT 1204 or PHYS 1007 or PHYS 1002) and (BIT 2004 or MATH 2004)and (BIT 2005 or MATH 2004). Restricted to students in the BIT degree program.
Lecture and tutorial three hours a week.

PLT 3004 [0.5 credit]
Design of Optical Components and Systems
Optical ray-tracing for analysing systems of sources, lenses, mirrors, prisms, fibers, diffractive elements, MEMS. Zemax® fundamentals, pupils, aspherics, non-sequential tracing, aberrations, image metrics, optimization/merit functions. Applications: imaging, illumination, lasers. Trade-offs, mechanical constraints, tolerances and cost. Physical optics modeling of bean propagation. Near-field diffraction and waveguides.
Prerequisite(s): PLT 2000.
Lectures / laboratory or tutorial five hours a week.

PLT 3008 [0.5 credit]
Communication Skills for PLT
Development of competence in written and oral communication. Focus on technical reports, proposals, and other related project documents; formal and informal oral presentations.
Prerequisite(s): restricted to students in the B.I.T. degree program.
Lecture and tutorial three hours a week.

PLT 3009 [0.5 credit]
Project Management
Identification, selection, initiation, and organization of projects. Risk assessment, budget issues, communication, project scheduling, performance monitoring and control. Emphasis on practical techniques related to the field of photonics using case studies.
Prerequisite(s): third year standing in the Photonics and Laser Technology program.
Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 3010 [0.5 credit]
Data Structures
Specification and design of abstract data types and their implementation as stacks, queues, trees, tables and graphs. Common and useful examples. Parsing and finite state machines. Analysis of algorithms, recursion, re-entrance. Special focus: abstraction, interface specification and hierarchical design using object-oriented programming.
Precludes additional credit for NET 3004.
Prerequisite(s): BIT 2400.
Lectures three hours a week, tutorial/laboratory two hours a week.

PLT 4000 [0.5 credit]
Applications of Quantum Physics
Basic elements of quantum mechanics will be reviewed. Applications of quantum mechanics covered may include: quantum optics, teleportation, information, computing and cryptography.
Prerequisite(s): BIT 2004 or MATH 2404.
Lectures three hours a week, problem analysis two hours alternate weeks.

PLT 4001 [0.5 credit]
Optoelectronic Devices
Review of semiconductors, semiconductor lasers, detectors, photovoltaics. Electro, magneto and acousto-optic modulation devices. Transmitters, receivers, photo diodes, fiber sensors, and amplifiers, Mach–Zehnder interferometers. Polarization-mode dispersion. Experiments on non-linear optical elements, Sagnac and ring resonator, optical modulation.
Prerequisite(s): PLT 3004.
Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 4004 [0.5 credit]
Biomedical Photonics
Biological and medical photonics. Effect of light on biological systems, medical imaging, medical treatments, biological research and bio/medical applications. Laser manipulation of cells, laser surgery, and photo-therapy. Biophotonic lab experiments with scanning confocal microscopes, endoscopes , DNA scanners.
Prerequisite(s): PLT 3003.
Lectures / laboratory or tutorial four hours a week.

PLT 4006 [0.5 credit]
Image and Signal Processing
Developing and evaluating algorithms for extracting the necessary information signals. Topics include filter design, fast transforms, adaptive filters, spectrum estimation and modeling, sensor array processing, image processing, motion estimation from images, applications in biomed, computer-aided tomography, image restoration, robotic vision, and pattern recognition.
Prerequisite(s): BIT 2400.
Lectures two hours a week, tutorial/laboratory two hours a week.

PLT 4007 [0.5 credit]
Introduction to Solid State Physics
The study of materials via the techniques of solid state physics. Topics include bonding and structure of crystals, energy band in insulators, semiconductors, and metals. Electrical conductivity, optical properties, lattice vibration, elasticity, point defects and dislocations.
Precludes additional credit for PLT 3005 (no longer offered).
Prerequisite(s): PLT 4000.
Lectures three hours a week.

PLT 4900 [1.0 credit]
Photonics Research Project
Research project develops students' ability to direct own learning and pursue advanced study in variety of subjects. Select topic, perform literature search, theoretical background, preliminary measurements, calculations, and design. Present findings in a preliminary thesis. Encourage writing technical papers. Research opportunities with industry and academia.
Prerequisite(s): fourth-year standing.
Tutorial hours arranged.

Summer session: some of the courses listed in this Calendar are offered during the summer. Hours and scheduling for summer session courses will differ significantly from those reported in the fall/winter Calendar. To determine the scheduling and hours for summer session classes, consult the class schedule at central.carleton.ca

Not all courses listed are offered in a given year. For an up-to-date statement of course offerings for the current session and to determine the term of offering, consult the class schedule at central.carleton.ca