Course Objectives
The first part of this course introduces different models of the interaction of light with biological tissue. The second part covers optical sensing and 3-D imaging techniques for medical diagnosis.

Prerequisites
ECE 3590 Electromagnetic Theory
ECE 3780 Signal Processing 1

Course Content
The following topics will be covered:

- Review of basic optics
- Interaction of light with biological tissue
- Rayleigh and Mie theory for a single scatterer
- Monte Carlo modeling of photon transport in biological tissue
- Radiative Transfer equation and diffusion theory
- Sensing of optical properties and spectroscopy
- Diffuse Optical Tomography
- Ballistic Imaging and Microscopy
- Optical Coherence Tomography

Accreditation Units
Mathematics: 0
Natural Science: 0
Complementary Studies: 0
Engineering Science: 100%
Engineering Design: 0

Web Page
TBA

Textbook

Other References
**Evaluation Details**
The final course grade is determined by the student’s performance on assignments, in laboratories, and on examinations. Students must complete all the laboratories in order to be eligible to receive a passing grade.

**Mid-Term(s)**
March 7, 2012

**Instructor**
Prof. Sherif Sherif  
Room: E3-509 EITC  
Telephone: (204) 474-6893  
Email: sherif@ece.umanitoba.ca

**Office Hours**
Wednesdays and Fridays from 1:00pm – 2:00pm or by appointment.

**Teaching Assistants**
Rajib Shake  
rajibs@cc.umanitoba.ca

**Voluntary Withdrawal Date**
Friday, March 16th, 2012.

**Requirements/Regulations**
- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor *in a timely manner* if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with Sections 4 and 6 of the Regulations dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

**Academic Integrity**
Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations and Requirements of the University of Manitoba, Section 7.1, students are reminded that plagiarism or any other form of cheating in examinations, assignments, laboratory reports or term tests is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty.
Learning Outcomes

1. An understanding of basic concepts of Optics and their biomedical applications.
2. An ability to analyze the interaction of light with biological tissue as a wave scattering phenomenon.
3. An ability to model and implement Monte Carlo algorithms for photon transport in biological tissue.
4. An ability to model and implement Monte Carlo algorithms for photon transport in biological tissue.
5. An understanding of Diffuse Optical Tomography and Optical Coherence Tomography.

Expected Competency Level **

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<th>Learning Outcome</th>
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*Attributes:
A1 A knowledge base for engineering
A2 Problem analysis
A3 Investigation
A4 Design
A5 Use of engineering tools
A6 Individual and team work
A7 Communication skills
A8 Professionalism
A9 Impact of engineering on society/environment
A10 Ethics and equity
A11 Economics and project management
A12 Life-long learning

**Competency Levels:
1 - Knowledge (Able to recall information)
2 - Comprehension (Able to rephrase information)
3 - Application (Able to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships)
5 - Synthesis (Able to combine separate elements into whole)
6 - Evaluation (Able to judge of the worth of something)

Student Contact Time (Hrs)

Lectures: 3 hrs lecture/week × 13 weeks/term = 39 hrs
Laboratories: 3 hrs laboratory × 3 weeks = 9 hrs
Tutorials: 3 hr tutorial × 2 weeks = 6 hrs

Evaluation

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<th>Component</th>
<th>Value (%)</th>
<th>Methods of Feedback *</th>
<th>Learning Outcomes Evaluated</th>
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* Methods of Feedback: F - formative (written comments and/or oral discussion), S - summative (number grades)