PHYS 780  Advance Imaging Technologies  2015

Offered:  Semester  1
Credit:    15 points
Pre-/Co-requisites:  No formal prerequisite, but an understanding of material to at least a C+ standard in PHYSICS 340 and 211 or ENGSCI 211 will be assumed.

Description

The physical basis and use of new imaging technologies in medicine, biomedicine and biotechnology, including electron microscopy, ultrasonic imaging, magnetic resonance imaging, CAT scanning and PET imaging. Biological applications of fluorescence and other areas of biophotonics, microarray analysis.

Aims

For most parts, the course will be research-oriented, i.e., will deal with subjects closely related to current research topics of the Biophotonics research laboratory of the Department as well as some biophysics. Students will also actively contribute to the course content through the preparation of oral presentations on cutting-edge imaging techniques and biosensors (see below). By the end of this course you should have a good idea of biophysics and biophotonics as well as some of the most advanced imaging technologies that are currently under development worldwide. The course assignments will also develop your presentation and numerical modelling skills.

Skills and knowledge to be gained

Students who passes this course should be able to:

• Able to present a research topics in a short presentation
• Able to analyse data in a scientific manner
• 3. Being able to write a code to analyse data
• 4. Gain a good understanding of optical imaging
• Gain a good understanding of the biophysics of the macromolecules
• Gain a good understanding of the mathematical skills to understand the above

Syllabus

• Current research in medical physics and imaging:  Fluorescence imaging or Coherent anti-Stokes Raman spectroscopy; Tomography; Data processing
• Optical Coherence Tomography:  Elements of the coherence theory of light; Principle of Optical Coherence Tomography (OCT); Wiener–Khinchin theorem and the calculation of the point-spread-function; Dispersion compensation in fibre implementations; some advanced topics, e.g., Fourier-OCT or polarisation-sensitive OCT
• Biophysics of macromolecules:  Macromolecular sedimentation; Macromolecular diffusion; Light scattering from solutions of macromolecules; Osmosis; Viscosity; Thermodynamic non-ideality
Learning activities and teaching methods

<table>
<thead>
<tr>
<th>Description</th>
<th>Study time</th>
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<tbody>
<tr>
<td>Lectures 16 × 1-hour</td>
<td>16 hours</td>
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<tr>
<td>Seminar Presentation (Laboratory) X 1</td>
<td>24 hours</td>
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<tr>
<td>Numerical Assignments X 2</td>
<td>36 hours X 2</td>
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<tr>
<td>Private study (1.5 hours per week)</td>
<td>(recommended)</td>
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Inclusive learning
Students are urged to discuss privately any impairment-related requirements face-to-face and/or in written form with the course convenor/lecturer and/or tutor.

Assessment

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<th>Form</th>
<th>Weight</th>
<th>Time</th>
<th>When</th>
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<tbody>
<tr>
<td>Assignments</td>
<td>20% (2 × 10%)</td>
<td>30 minutes</td>
<td>weeks 6, 12</td>
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<tr>
<td>Laboratory work</td>
<td>10%</td>
<td>30 minutes</td>
<td>Due the week before last exam period</td>
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<tr>
<td>Exam</td>
<td>70%</td>
<td>3 hours</td>
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Academic Integrity
The University of Auckland will not tolerate cheating, or assisting others to cheat, and views cheating in coursework as a serious academic offence. The work that a student submits for grading must be the student's own work, reflecting his or her learning. Where work from other sources is used, it must be properly acknowledged and referenced. This requirement also applies to sources on the world-wide web. A student's assessed work may be reviewed against electronic source material using computerised detection mechanisms. Upon reasonable request, students may be required to provide an electronic version of their work for computerised review. Please visit the below link for further information:

Resources
There is no formal textbook. Appropriate references will be suggested by each lecturer.

Feedback
Marked script and model solutions to assignments; marked exam script (if requested)

Enrolment
Typical enrolment Semester 1: 10-15