BMED4823 / ECE3803 / ME4823 : Introduction to Biomedical Optics

Instructors:

Professor Shu Jia
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OFFICE: UAW 2112
OFFICE HOUR: Available after each lecture (***in person***) or by email appointment (***online, in person***)

TA: Zhi Ling
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TA HOUR: ***weekly online***, TBA on Canvas

Class Time and Location:

Time: ***M&W 12:30 pm - 1:45 pm***
Location: ***Cherry Emerson 204 and Remote mini-projects***

Course Objectives:

This Introduction to Biomedical Optics course is to survey fundamentals and applications of optical science, engineering and technology to a broad range of laboratory and clinical biomedical problems. The course is one of the core courses for students interested in the interface of optics and its biomedical applications such as optical imaging, stimulation, diagnostics and therapeutics.

As part of this course, students are expected to:

- apply their knowledge of mathematics and physics to understand optical concepts.
- demonstrate engineering capability to create solutions and interpret data that meet biomedical needs for public health.
- engage in both formal and informal oral professional presentation exercises.
- identify and apply coursework and the necessary expertise to address unmet biomedical problems.

Course Material:

Required: Lecture Notes and Reading Materials
Optional:
Quantitative Biomedical Optics: Theory, Methods, and Applications by Bigio and Fantini
Introduction to Optical Microscopy by Mertz

Grade Assessment:

4	Problem Sets	20%,	5% EA
2	Mid-terms	20%,	10% EA
8	Mini-Projects	40%,	5% EA
1	Final Exam	20%.	

The final grade will not be rounded and will be assigned as a letter grade according to the following scale:
A 90-100%; B 80-89%; C 70-79%; D 60-69%; F 0-59%

Attendance & Absences:

Students with medical, family or other critical emergencies should contact the Office of the Dean of Students. Students should familiarize themselves with http://www.catalog.gatech.edu/rules/4/. To the extent possible, students should communicate excused absences in advance; when not possible, the student shall communicate their excused absence as soon after the emergency as can reasonably be expected for the situation. Late assignments will not be accepted for credit without an excused absence. As noted above, under Mode of Instruction, in-person class attendance is encouraged but is not required. Therefore, students should be able to attend this class in a fully remote fashion. However, please note that while 100% reliable internet cannot be guaranteed, the lectures are recorded regardless of periodic internet connectivity problems. In other words, all class content will be available and uploaded for students to view after the fact.

Honor Code:

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/.

Accommodations for Students with Disabilities:

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also email the instructor as soon as possible in order to set up a time to discuss your learning needs.

Class Schedule

Date	Course contents
08/19	1. Overview
	2. Basic optics: definitions, photon, frequency, wavelength, ray optics, reflection, refraction
08/26	3. Basic optics: lens and image formation, light propagation, light-matter interaction
	4. Lasers: introduction, laser physics, medical laser safety fundamentals
08/28	**Mini-project 1**
09/02	*No Class – Labor Day*
09/04	5. Lasers: overview of diagnosis and therapy fundamentals with lasers
09/09	6. Laser-tissue interactions: fundamentals, photophysics of laser therapy
	7. Laser-tissue interactions: therapeutic applications
09/11	**Mini-project 2**
09/16	8. Review session
09/18	9. Midterm I
09/23	10. Optical fibers: fundamentals and light propagation in fibers
	11. Laser-fiber systems: fundamentals, applications, clinical flow chart
09/25	**Mini-project 3**
09/30	12. Optical tweezers: fundamentals and instrumentation
	13. Optical tweezers: therapeutic applications
10/02	**Mini-project 4**
10/07	14. Tissue autofluorescence and biomarkers
10/14	15. *No Class - Fall Break*
10/16	16. Diagnostic optical spectroscopy: fundamentals and instrumentation
10/21	17. Diagnostic optical spectroscopy: applications / Diffuse optics: fundamentals, instrumentation and applications
	18. Diffuse optics: optical tomo/mammography and brain imaging
10/23	**Mini-project 5**
10/28	19. Review session
10/30	20. Midterm II
11/04	21. Photoacoustics: fundamentals, instrumentation and applications
	22. Neurophotonics: brain stimulation, optogenetics, mini-microscopy
11/06	**Mini-project 6**
11/11	23. Endoscopy: fundamentals, instrumentation and applications
	24. Computational biomedical optics
11/13	**Mini-project 7**
11/18	25. Modern optical microscopy for biomedical applications I
11/20	**Mini-project 8**
11/25	26. Modern optical microscopy for biomedical applications II
11/27	27. *No Class - Student Recess*
12/02	28. Review session
TBA	29. Final Exam

Notes: **Late Work Policy: No late submissions** (homework, exams, etc.) are allowed unless special circumstances are subject to Georgia Tech rules (e.g., medical/family emergencies and instructor approvals) and the request is made before the original due date. There are no exceptions to this rule. The recorded uploading time on Canvas will be used as your submission time. Submit in advance to avoid any delay due to Canvas or network problems.