

COURSE CONTENT

Academic Year	2021/2022	Semester	2	
Course Coordinator	Assoc Prof. Liu (Quan		
Course Code	BG4214			
Course Title	Biomedical Optic	cs (Core Elective)		
Pre-requisites	Nil			
No of AUs	3			
Contact Hours	39 hours lecture	, 0 hours tutorial		
Proposal Date	8 Dec 2020			

Course Aims

This course aims to provide you with the basic optics principles, the understanding of typical interactions between light and biological matter and the survey of common optical spectroscopy and imaging techniques in biomedical optics. The knowledge will be useful if you will be involved in any biomedical industry or academic tasks requiring the use of optical techniques.

Intended Learning Outcomes (ILO)

After completing the course, the students should be able to

- 1. discuss the basic optics principles;
- 2. discuss the typical interactions between light and biological matter
- 3. evaluate common optical spectroscopy and imaging techniques in respective applications.

Course Content

- Introduction to biomedical optics
- Light basics
- EM wave theory basics
- Polarization basics
- Interference
- Diffraction
- Light sources
- Optical fiber
- Geometrical optics basics
- Optical spectroscopy and spectral imaging
- Guest topics about biomedical optics techniques

Assessment (includes both continuous and summative assessment)

LO Tested	Programme LO or Graduate Attributes	Trongining	/Individual	rubrics
1,	EAB, SLO, a, b	30%	Individual	Refer to appendix 1
1, 2, 3	EAB, SLO, c, d, e	40%	Individual	Refer to appendix 1
1, 2, 3	EAB, SLO, a, b, c	30%	Individual	Refer to appendix 1
		100%		
	LO Tested 1, 1, 1, 2, 3 1, 2, 3	LO TestedProgramme LO or Graduate Attributes1,EAB, SLO, a, b1, 2, 3EAB, SLO, c, d, e1, 2, 3EAB, SLO, a, b, c	LO TestedProgramme LO or Graduate Attributes1,EAB, SLO, a, b30%1, 2, 3EAB, SLO, c, d, e40%1, 2, 3EAB, SLO, a, b, c30%	LO TestedProgramme LO or Graduate Attributes/Individual1,EAB, SLO, a, b30%Individual1, 2, 3EAB, SLO, c, d, e40%Individual1, 2, 3EAB, SLO, a, b, c30%Individual1, 2, 3EAB, SLO, a, b, c30%Individual

Course Intended	Cat	EAB'	s 12 G	Gradua	te Attri	butes	*						
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2. Discuss th	ne typical int	eractio	ns be	s, etwee	n liaht	and	bioloc	iical r	natter			a,b, a.b	<u>u</u>
3. Evaluate	common opt	ical teo	chniqu	ues in	respe	ctive	appli	catio	ns.			a.c.	е
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utorial	TBL classro	om dis	scuss	ion se	ession	s on t	tutoria	al que	stions	and	relate	ed top	ics
eading and Refer Eugene Hecht, of Introduction to E opyright © 2003 Jo ithor(s): Paras N. iblished Online: 2 nk (requiring NTU p://ezlibproxy1.nt Biomedical Optic opyright © 2007 Jo ithor(s): Lihong V Durse Policies ar eneral: Students a d tests by due da signments and co scussions and act	rences Optics, 4th e Biophotonics ohn Wiley & Prasad 1 JAN 2004 ID and pass u.edu.sg/log s: Principles ohn Wiley & . Wang, Hsir of Student I are expected ites. Student ourse related ivities.	ed., Add Sons, sword f in?url= and Ir Sons, n-I Wu Respo I to cor ts are d anno	dison Inc. to log <u>=http:/</u> nagin Inc. <i>A</i> nsibi nplete expect uncer	in): //dx.du g All rigl e all o cted to ments	oi.org/ oi.org/ hts res online a take s. Stud	02. 10.10 served activit respo ents	002/04 d. ties ar onsibi are e	4714	65380 ke all s o follov ed to	sched v up v partic	uled vith c ipate	assig ourse in all	nmer note tutor

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the <u>academic integrity website</u> for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Liu Quan	N1.3 B2-10	6316 8748	<u>quanliu@ntu.edu.sg</u>

Planned Weekly Schedule

Week	Торіс	Course LO	Readings/Activities
1	Introduction to biomedical optics	1,2,3	Face to face lecture
2	Light basics	1	Face to face lecture
3	EM wave theory basics	1	Face to face lecture
4	Polarization basics	1	Face to face lecture
5	Interference	1	Face to face lecture
6	Diffraction	1	Face to face lecture
7	Light sources Laser	1	Face to face lecture
8	Optical fiber	1	Face to face lecture
9	Geometrical optics basics	1	Face to face lecture
10	Optical spectroscopy and spectral imaging	2,3	Face to face lecture
11	Guest topic 1 (e.g. Optical microscopy)	1,2,3	Face to face lecture
12	Guest topic 2 (e.g. Optical coherence	1,2,3	Face to face lecture
	tomography)		
13	Review	1,2,3	Face to face lecture

Criteria	Unsatisfactory: <40%	Borderline: 40% to 49%	Satisfactory: 50% to 69%	<u>Very good: 70% to</u> 89%	Exemplary: >90%
Knowledge Discuss the basic optics principles;	Poor familiarity of the basic optics principles	Below average familiarity of the basic optics principles	Average familiarity of the basic optics principles	Good familiarity of the basic optics principles	Very good familiarity of the basic optics principles
Comprehen sion Discuss the typical interaction s between light and biological matter	Poor understanding of the basic optics principles and light-tissue interaction	Below average understanding of the basic optics principles and light-tissue interaction	Average understanding of the basic optics principles and light-tissue interaction	Good understanding of the basic optics principles and light-tissue interaction	Thorough understanding of the basic optics principles and light- tissue interaction
Application Evaluate common optical spectrosco py and imaging techniques in respective application s.	Poor understanding of pros and cons of common optical techniques; Unable to select proper optical techniques for practical problems at all	Below average understanding of pros and cons of common optical techniques; Excellent ability to select proper optical techniques for practical problems with possibly major issues	Average understanding of pros and cons of common optical techniques; Average ability to select proper optical techniques for practical problems with some noticeable issues	Good understanding of pros and cons of common optical techniques; Good ability to select proper optical techniques for practical problems with minor issues	Thorough understanding of pros and cons of common optical techniques; Excellent ability to select proper optical techniques for practical problems

Appendix 2: The EAB (Engineering Accreditation Board) Accreditation SLOs (Student Learning Outcomes)

- a) **Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems
- b) **Problem Analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- c) **Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- d) **Investigation:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- e) **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
- f) **The engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- g) **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.
- h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- i) **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.
- j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- k) Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Life-long Learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change