

生物医学光子学课程教学大纲

课程基本信息 (Course Information)					
课程代码 (Course Code)	BI355	*学时 (Credit Hours)	32	*学分 (Credits)	2
*课程名称 (Course Name)	生物医学光子学 Biomedical Optics				
课程性质 (Course Type)	限选课 (elective course)				
授课对象 (Audience)	本科四年级学生				
授课语言 (Language of Instruction)	双语 Bilingual (Chinese & English)				
*开课院系 (School)	生物医学工程学院 (School of Biomedical Engineering)				
先修课程 (Prerequisite)	大学物理、高等数学和生物学 (Physics, Mathematics and Biology)				
授课教师 (Instructor)	周传清 (Chuanqing Zhou)	课程网址 (Course Webpage)			
*课程简介 (Description)	<p>生物医学光子学是光学技术与生物医学相结合、交叉的一门前沿学科，也是一门新兴的技术领域，又是生物医学工程专业的专业基础课程。在学生具备一定的物理学、数学和生物学知识背景下，本课程阐述现代光学基本原理，激光与生物组织相互作用机制，光子在生物组织中的传输，基本的光学理论和激光技术在生物医学诊断、治疗与研究中的应用原理及相关技术，包括共聚焦成像，光谱与荧光成像、光学相干层析成像、光声成像以及激光治疗技术等，使学生掌握生物医学光子学的基本原理、技术及其在生物医学中的应用，了解生物医学光子学研究的世界前沿课题，为以后的生物光子学相关研究和应用打下坚实的基础。(中文需 300-500 字)</p>				
*课程简介 (Description)	<p>Biomedical optics has been one of the most rapidly developing interdisciplinary subject in biomedical engineering field, covering the modern optics, laser technology and biomedicine. It also has been a basic course for BME students. With the knowledge of Physics, Mathematics, and Biology, this course will introduce the knowledges of basci principles of modern optics, laser-tisse interactions, light transportation in tissues, biomedical optical technologies and its applications on diagonosis, therapy, and researches, including modern confocal microscopy, spectroscopy and fluorescent imaging, optical coherence tomography, photoacoustic tomography, and laser therapies. With this course, the students will understand the basic principles and technologies of biomedical optics and its applications on biomedicine, and learn the frontiers of the biomedical optics. (英文需 300-500 字)</p>				
课程教学大纲 (course syllabus)					

<p>*学习目标 (Learning Outcomes)</p>	<ol style="list-style-type: none"> 1. 理解和描述激光原理和激光安全[a]。 (Ability to understand and describe the basic principle of laser and laser safety) 2. 理解和描述医用激光分类特征[a] (Ability to understand and describe the characteristics of medical lasers) 3. 理解生物组织的光学特性[a,e] (Ability to understand the optical properties of biological tissues) 4. 分析生物组织光子散射过程[a,e] (Ability to identify and analyze the process of light scattering in tissues) 5. 分析生物组织光子吸收过程[a,e] (Ability to identify and analyze the process of light absorption in tissues) 6. 分析生物组织光子传输规律[a,e,k] (Ability to analyze the light transportation in tissues) 7. 解释激光与组织热相互作用机制及其医学应用[a,e] (Ability to explain the process of laser-tissue thermal interaction and medical applications) 8. 解释激光与组织化学相互作用机制及其医学应用[a] (Ability to explain the process of laser-tissue chemical interaction and medical applications) 9. 解释激光与组织机械相互作用机制及其医学应用[a] (Ability to explain the process of laser-tissue mechanical interaction and medical applications) 10. 理解和描述代表性弹道光子成像模式的基本原理, 包括共聚焦显微成像, 光学相干层析成像, 光声显微成像[a,c,e,j,k] (Ability to understand and describe the principles of the representative ballistic optical imaging modalities, including confocal microscopy, optical coherence tomography, photoacoustic microscopy) 11. 理解临床光学诊断和激光治疗的基本原理[a,c,g,h,j] (Ability to understand the basic principles of clinical optical diagnosis and laser therapy) 																							
<p>*教学内容、进度安排及要求 (Class Schedule & Requirements)</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">教学内容</th> <th style="width: 10%;">学时</th> <th style="width: 20%;">教学方式</th> <th style="width: 20%;">作业及要求</th> <th style="width: 15%;">基本要求</th> <th style="width: 10%;">考查方式</th> </tr> </thead> <tbody> <tr> <td>绪论 (Introduction to biomedical optics)</td> <td>2</td> <td>课堂教学 (lecture)</td> <td></td> <td>了解光学和激光技术的发展史以及光子生物医学的历史及现状</td> <td></td> </tr> <tr> <td>现代光学理论 (Basic principles of modern optics)</td> <td>4</td> <td>课堂教学 (lecture)</td> <td>1) 阐述主要光学理论要点 (To explain the theories of imaging, coherence, diffraction, holography and quantum</td> <td>掌握基本的光学原理与定理以及干涉、衍射和全息原理及技术, 掌握光的量子特性 (To understand the</td> <td>课堂提问与课后作业 (Q&A, and homework)</td> </tr> </tbody> </table>	教学内容	学时	教学方式	作业及要求	基本要求	考查方式	绪论 (Introduction to biomedical optics)	2	课堂教学 (lecture)		了解光学和激光技术的发展史以及光子生物医学的历史及现状		现代光学理论 (Basic principles of modern optics)	4	课堂教学 (lecture)	1) 阐述主要光学理论要点 (To explain the theories of imaging, coherence, diffraction, holography and quantum	掌握基本的光学原理与定理以及干涉、衍射和全息原理及技术, 掌握光的量子特性 (To understand the	课堂提问与课后作业 (Q&A, and homework)					
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现代光学理论 (Basic principles of modern optics)	4	课堂教学 (lecture)	1) 阐述主要光学理论要点 (To explain the theories of imaging, coherence, diffraction, holography and quantum	掌握基本的光学原理与定理以及干涉、衍射和全息原理及技术, 掌握光的量子特性 (To understand the	课堂提问与课后作业 (Q&A, and homework)																			

			optics) 2) 光学成像计算 (optical imaging calculation)	theories of imaging, coherence, diffraction, holography and quantum optics)	
激光原理与技术 (Laser: principle and technology)	4	课堂教学 (lecture)	1) 了解激光原理 (basic principle of laser) 2) 了解激光特性 (feature of laser) 3) 了解激光安全 (laser safety) 4) 了解医用激光器及其分类 (medical lasers and classification)	掌握激光的产生原理、激光特性以及激光的相关技术和激光防护知识 (To understand the basic principle of laser, the feature of laser, laser safety, and laser technologies)	课堂提问与课后作业 (Q&A, and homework)
光与组织 (Light and Matter)	2	课堂教学 (lecture)	利用组织光学特性计算光在组织中的传播规律 (To calculate the light transportation in the biological tissues)	掌握组织光学特性及光在组织中的传播规律 (To understand theories of the tissue optics and light transportation)	课堂讨论与课后作业 (Q&A, and homework)
激光与组织相互作用 (Laser-tissue interactions)	4	课堂教学 (lecture)	阐述激光与组织相互作用的分类和基本原理 (To explain the laser-tissue interaction mechanism and classifications)	掌握激光与组织相互作用的基本原理、分类, 了解其应用 (To understand laser-tissue interaction mechanism, classification)	课堂讨论或课后作业 (Q&A, or homework)

				and applications)	
临床激光治疗技术 (Selective topics on clinical laser therapies)	2	课堂教学 (lecture)	从临床应用的激光治疗技术，分析其内在的原理 (To analyze the mechanism of laser treatments)	了解基于激光与组织相互作用的基本原理，了解其临床应用 (To understand the clinical laser therapy based on the knowledge of laser-tissue interaction mechanisms)	课堂讨论 (Q&A)
激光治疗技术最新进展 (Selective topics on the frontiers of laser therapies)	2	汇报与讨论 (Presentation and discussion)		了解基于激光与组织相互作用的基本原理，了解其临床应用 (To understand the clinical laser therapy based on the knowledge of laser-tissue interaction mechanisms)	PPT 汇报 (PPT presentations)
生物医学光学成像 (Selective topics on biomedical optical imaging)	8	课堂教学 (lecture)	1) 分析主要生物光学成像的基本原理及其应用 (To analyze the basic principles of biomedical optical imaging and applications) 2) 系统原理设计及关键参数计算 (To design the	掌握生物光学成像的基本原理和相关技术 (To understand the basic principles of biomedical optical imaging and corresponding technologies)	课堂讨论或课后作业 (Q&A, or homework)

				biomedical optical imaging system and calculate the key parameters)		
	生物光子学诊断技术前沿热点 (Selective topics on the frontiers of biomedical optical diagnosis)	2	汇报与讨论 (Presentation and discussion)		了解生物医学光子学的若干前沿热点问题 (To be familiar with the hot topics and developing trends of biomedical optics)	PPT 汇报 (PPT presentations)
	期末考试 (Final exam)	2				
*考核方式 (Grading)	总成绩 (Total score) = 考勤(attendance) 10% +作业(homework) 20% +报告(presentation or written reports) 20% +期末考试(final exam)50%					
*教材或参考资料 (Textbooks & Other Materials)	1) Laser-Tissue Interaction: Fundamentals and Applications, Markolf H. Niemz, Springer, 2007, 3th Edition, ISBN 978-3-540-72191-8 2) Biomedical Optics: Principles and Imaging, Lihong V. Wang and Hsin-I W, Wiley, 2007, ISBN: 978-0-471-74304-0 3) 生物光子学导论, Paras N. Prasad 著, 何赛灵译, 浙江大学出版社, 2006, ISBN 7-308-04974-4/Q.055 4) 生物医学光子学新技术及应用, 张镇西, 科学出版社, 2008, ISBN 978-7-03-021430-0 需按以下格式填写: 教材信息一条 (按字段填写, 并且可按字段选择性导出): 教材名称、主编、第一主编是否为我校教师、出版社、出版年月、版次、ISBN 号、课程使用该教材届数、是否外文教材、是否国家级规划教材 参考资料可列 3-5 条, 文本框自由填写					
其它 (More)						
备注 (Notes)						

备注说明:

1. 带*内容为必填项。
2. 课程简介字数为 300-500 字; 课程大纲以表述清楚教学安排为宜, 字数不限。