

上海交通大学研究生课程开设申请表

New Graduate Course Application Form, SJTU

课程基本信息 Basic Information				
*课程名称 Course Name	(中文 Chinese) 材料设计中的仿生学原理			
	(英文 English) Bionic Principles in Material Design			
*学分 Credits	2	*学时 Teaching Hours	32 课时 (1 学分≥16 课时)	
*开课学期 Semester	春季学期 Spring	*是否跨学期 Cross-semester?	否 No	跨 Spanning over 个学期 Semesters (含夏季学期)。
*课程性质 Course Category	专业课 Specialized Course	*课程分类 Course Type	全日制课程 For full-time students	
*授课语言 Instruction Language	中文 Chinese	主要授课方式 Teaching Method	课堂教学 In class teaching	
*成绩类型 Grade	等第制 Letter grading	主要考核方式 Exam Method	论文 Essay	
*开课院系 School	材料科学与工程学院			
所属学科 Subject				
负责教师 Person in charge	姓名 Name	工号 ID	单位 School	联系方式 E-mail
	宋阳	15329	材料科学与工程学院	Nanosurface@sjtu.edu.cn
课程扩展信息 Extended Information				
*课程简介 (中文) Course Description	<p>(分段概述课程定位、教学目标、主要内容、先修课程等；不少于 200 字。)</p> <p>本课程通过研究天然生命系统的结构和特性，揭示生物对象的工作原理，以此来为工程材料设计提供新思想和新方法。仿生材料设计契合国家低碳、绿色环保、可持续发展理念，更高效地解决材料制备设计中的模型优化问题，赋予材料特定功能，并使其更好地适用于实际应用场景。本课程将理论知识点与各分支学科的前沿发展相结合，强调问题导向，强化学生发现、分析和解决问题的能力，遵循新兴仿生学相关学科发展与创新规律，强调其中新原理、新知识、新成果、新应用的理解和运用。本课程资料大多来自于近二三十年的最前沿的研究进展，让学生切身体会仿生学领域的快速发展的动态，激发学生的科研热情，培养学生的科研兴趣和创新思维。</p>			
*课程简介 (English) Course Description	<p>(须与中文一致，翻译请力求信达雅。)</p> <p>This course summarizes the recent advances for the design of engineering materials inspired from structure and properties of natural living systems. The design of biomimetic materials conforms to the strategy of low-carbon, green economy, and sustainable development in our national policies. It can more efficiently optimize the problems found in material preparation and design, endowing materials with specific functions that are better adaptive to actual application scenarios. This course combines theoretical knowledge with the cutting-edge development in different fields, emphasizing research questions and strengthening the students' ability to discover, analyze and solve problems. Following the development and innovation laws of emerging bionics, this course emphasizes new principles, understanding and application of new knowledge, new achievements, and new applications. Most of the materials in this course come from the most cutting-edge research progress in the past 20 to 30 years, so that students can experience the rapid development in the field of bionics. This would stimulate the students' enthusiasm for scientific research, and cultivate students' scientific research interest and innovative thinking.</p>			

<p>*教学大纲 (中文) Syllabus</p>	<p>(建议列表形式, 各列内容: 章节、主要内容、课时数、教学方式)</p> <p>第一章 结构仿生材料 (共 10 课时)</p> <p>1.1 仿生学概述与生物矿化原理 2 课时 课堂讲授</p> <p>1.2 表界面结构仿生材料 2 课时 课堂讲授</p> <p>1.3 空间序构仿生材料 2 课时 课堂讲授</p> <p>1.4 多相复合仿生材料 2 课时 课堂讲授</p> <p>1.5 多尺度结构仿生材料 2 课时 课堂讲授</p> <p>第二章 功能仿生材料 (共 10 课时)</p> <p>2.1 仿生纳米颗粒 2 课时 课堂讲授</p> <p>2.2 仿生微纳液滴 2 课时 课堂讲授</p> <p>2.3 一维仿生: 纳米线与纳米纤维 2 课时 课堂讲授</p> <p>2.4 二维仿生: 功能膜材料 2 课时 课堂讲授</p> <p>2.5 三维仿生: 自修复材料 2 课时 课堂讲授</p> <p>第三章 系统仿生与器件 (共 12 课时)</p> <p>3.1 仿生传感器 2 课时 课堂讲授</p> <p>3.2 仿生能量转换器 2 课时 课堂讲授</p> <p>3.3 仿生驱动器 2 课时 课堂讲授</p> <p>3.4 仿生机器人与植入器械 2 课时 课堂讲授</p> <p>3.5 器官芯片与人造器官 2 课时 课堂讲授</p> <p>3.6 课堂讨论与报告 2 课时 课堂讲授</p>
<p>*教学大纲 (English) Syllabus</p>	<p>(须与中文一致, 翻译请力求信达雅。)</p> <p><u>Chapter 1. Natural Structure-Inspired Materials</u></p> <p>1.1 Introduction to Bionics and Biomineralized Structures</p> <p>1.2 Biointerface-inspired Materials</p> <p>1.3 Natural Spatial Configuration-inspired Materials</p> <p>1.4 Multi-phase Biomimetic Composite Materials</p> <p>1.5 Biomimetic Hierarchical Materials</p> <p><u>Chapter 2. Nature-Inspired Functional Materials</u></p> <p>2.1 Biomimetic Functional Particles</p> <p>2.2 Biomimetic Functional Droplets</p> <p>2.3 One-dimensional Bionics: Nanowires and Nanofibrils</p> <p>2.4 Two-dimensional Bionics: Functional Membrane</p> <p>2.5 Three-dimensional Bionics: Self-healing Materials</p> <p><u>Chapter 3. Bionic Systems and Devices</u></p> <p>3.1 Bioinspired Sensors</p> <p>3.2 Bioinspired Transducers</p> <p>3.3 Bioinspired Actuators</p> <p>3.4 Bioinspired Robotics & Implantable Devices</p> <p>3.5 Organ-on-chip & Artificial Organs</p> <p>3.6 In-class Discussion & Presentation</p>
<p>*课程要求 (中文) Requirements</p>	<p>(课程考核方式、考核标准等; 不少于 50 字)</p> <p>1.课堂报告要求学生结合自己感兴趣的课题做 5 分钟的 ppt 介绍, 重点叙述仿生学原理如何应用于材料的优化设计, 成绩占比 30%;</p> <p>2.要求学生撰写仿生材料主题的课程论文, 成绩占比 70%;</p> <p>总分评定需要 ≥ 60 分</p>
<p>*课程要求 (English) Requirements</p>	<p>(须与中文一致, 翻译请力求信达雅。)</p> <p>1. In-class presentation for 5 minute, specifying how to apply the concept of bionics in the design of new materials. This oral defense takes over 30% of total score.</p> <p>2. Write a short summary with the theme of biomimetic materials. This short essay takes over 70% of the total score.</p> <p>Overall rating must be ≥ 60pts/100pts</p>
<p>*课程资源 (中文) Resources</p>	<p>(教材、教参、网站资料等。)</p> <p>随堂课件</p>
<p>*课程资源 (English) Resources</p>	<p>(须与中文一致, 请力求信达雅。)</p> <p>In-class courseware</p>