上海交通大学研究生课程开设申请表

New Graduate Course Application Form, SJTU

<table>
<tr><th colspan="6">课程基本信息 Basic Information</th></tr>
<tr><td>*课程名称
Course Name</td><td colspan="5">（中文 Chinese）智能生物医用材料
（英文 English）Smart Biomedical Materials</td></tr>
<tr><td>*学分
Credits</td><td>48</td><td>*学时
Teaching Hours</td><td colspan="3">3（1 学分≥16 课时）</td></tr>
<tr><td>*开课学期
Semester</td><td>秋季学期 Fall</td><td>*是否跨学期
Cross-semester?</td><td>否 No</td><td colspan="2">跨 Spanning over 个学期
Semesters（含夏季学期）。</td></tr>
<tr><td>*课程性质
Course Category</td><td>专业课 Specialized Course</td><td>*课程分类
Course Type</td><td colspan="3">全日制课程 For full-time students</td></tr>
<tr><td>*授课语言
Instruction Language</td><td>中文 Chinese</td><td>主要授课方式
Teaching Method</td><td colspan="3">课堂教学 In class teaching</td></tr>
<tr><td>*成绩类型
Grade</td><td>等第制 Letter grading</td><td>主要考核方式
Exam Method</td><td colspan="3">考查 Tests</td></tr>
<tr><td>*开课院系
School</td><td colspan="5">材料科学与工程学院</td></tr>
<tr><td>所属学科
Subject</td><td colspan="5">材料科学与工程</td></tr>
<tr><td rowspan="2">负责教师
Person in charge</td><td>姓名 Name</td><td>工号 ID</td><td>单位 School</td><td colspan="2">联系方式 E-mail</td></tr>
<tr><td>袁广银</td><td></td><td>上海交通大学材料科学与工程学院</td><td colspan="2">gyyuan@sjtu.edu.cn</td></tr>
<tr><th colspan="6">课程扩展信息 Extended Information</th></tr>
<tr><td>*课程简介
(中文)
Course Description</td><td colspan="5">（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。）

生物医用材料在国民健康、社会经济等方面扮演着日益重要的角色，也是目前世界上研究的热点。涉及材料学、化学、医学、生物学、工程学等多领域的科学技术，属于新兴交叉学科。
智能生物医用材料代表着新一代生物材料的未来发展方向。课程内容将采用“前沿研究与基础理论教学紧密结合”的方式，不仅涵盖了生物材料概念和内涵、相关材料学基础知识、基本生物学概念、生物体-材料相互作用等生物医用材料的核心基础内容，更将着重于前沿研究领域智能化生物医学功能的基本智能驱动原理、设计原则、制备方法技术、临床应用等，包括“体内可控降解、组织诱导再生、体内微环境刺激响应、人造器官”等各类典型的智能化医用功能。将搭建起如可降解医用金属、环境刺激响应高分子等各类材料与先进生物医学应用之间的联系。课程以课堂理论教学为主，并与实践和前沿研究结合，通过实验操作、典型案例介绍学习、小组讨论等多种授课方式的有机结合让学生了解和加深如何将基础知识应用到生物材料的先进智能功能的实现上。本门课程的学习旨在培养学生新一代智能生物医用材料的设计、制备与性能评估的知识和能力以及进行多学科交叉研究的兴趣和技能。
先修课程：材料科学基础、材料化学、材料物理。</td></tr>
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*课程简介 （English） Course Description	（须与中文一致，翻译请力求信达雅。） Biomaterials, materials used in medicine, play an increasingly important role in national health and social economy, and attract intense research attention worldwide. Multiple scientific fields including materials, chemistry, medicine, biology and engineering are involved in biomaterials, which is emerging as a new interdisciplinary direction. Intelligent biomaterials represent the future direction of the next-generation biomaterials. In this course, the "combination of cutting-edge research and fundamental theory" teaching approach is adopted, covering the fundamental theories of biomaterials, basic knowledge of relevant materials, basic biological concepts, material-biological species interactions and other core contents; moreover, it is focused on the frontier research related intelligent driving theories, design principles, preparation methods, clinical applications, including controlled degradation, induced tissue regeneration, environment stimuli response, artificial organs and other typical intelligent bio-functions. The course establishes a bridge between materials such as biodegradable medical metals, stimuli responsive polymers and advanced biomedical applications. The course teaching is mainly based on in-class theory teaching, and combined with practice and cutting-edge scientific research, with the employment of combinatory teaching methods of experimental operations, field visits, typical case study, group discussions to help students understand how to apply the basic knowledge to the achievement of advanced functions of biomaterials. This course aims to develop the students' knowledge and capabilities of design, preparation and evaluation of new-generation intelligent biomaterials, as well as their interests and abilities in multidisciplinary research. Prerequisite courses includes Fundamentals of Material Science, Material Chemistry and Material Physics.
*教学大纲 (中文) Syllabus	（建议列表形式，各列内容：章节、主要内容、课时数、教学方式）

教学内容	授课学时	教学方式	授课教师
1. 智能生物医用材料概论 1.1 生物医用材料的定义与分类 1.2 生物医用材料的发展历程 1.3 生物医用材料的特点与产业发展现状 1.4 生物医用材料的应用简介 1.5 生物医用材料研究现状与智能化发展趋势	3	课堂讲授	袁广银
2. 生物相容性 2.1 生物医用材料对生物体的作用 2.2 生物相容性定义与内容（组织相容性、血液相容性等） 2.3 材料的生物相容性评价	3	课堂讲授	裴佳
3.可控降解的智能医用金属材料 3.1 医用金属材料概论及其体内降解的理论基础 3.1.1 传统医用金属材料的临床应用现状 3.1.2 传统医用金属材料临床存在的主要问题 3.2 可控降解医用金属设计、制备及体内外研究 3.2.1 可控降解镁合金材料的设计、制备和临床应用基础研究 3.2.2 可控降解锌合金材料的设计、制备和临床应用基础研究 3.3 医用金属降解和细胞相容性实验	12	课堂讲授 + 实验	袁广银
4.先进功能生物陶瓷材料 4.1 惰性生物陶瓷	3	课堂讲授	裴佳

	4.2 生物活性陶瓷 4.3 生物压电智能陶瓷			
	5.智能医用高分子水凝胶材料 5.1 医用高分子水凝胶概论 （2 课时） 5.2 智能医用高分子水凝胶材料设计、结构及功能（4 课时） 5.3 智能医用高分子水凝胶材料的功能（3 课时） 5.4 高分子水凝胶材料的生物医用 （4 课时） 5.5 医用仿生水凝胶制备表征实验（2 课时）	15	课堂讲授 + 实验	冯传良
	6.生物材料表界面与智能功能涂层 （6 课时） 6.1 蛋白质、细胞与材料的相互作用（3 课时） 6.1.1 蛋白质的结构、功能及蛋白质吸附 6.1.2 细胞膜的结构、识别及细胞粘附 6.1.3 材料表面对蛋白质、细胞行为影响 6.2 功能生物表界面设计与应用 （3 课时） 6.2.1 仿生生物活性表界面 6.2.2 抗生物黏附表面 6.2.3 智能药物递送涂层	6	课堂讲授	裴佳
	7. 人造器官、组织工程与智能诱导再生修复 7.1 人工器官、组织工程概论 7.2 再生修复材料及其进展 7.3 组织工程支架的诱导再生修复设计、结构及其应用	3	课堂讲授	裴佳
	8.生物 3D 打印技术 8.1 3D 打印概论及目前技术进展 （1 课时） 8.2 3D 打印技术在生物医学中应用（2 课时）	3	课堂讲授 + 学生报告讨论	袁广银

*教学大纲（English）Syllabus

（须与中文一致，翻译请力求信达雅。）

Content	Hours	Format	Instructor
1. Introduction to smart biomedical materials 1.1 Definition and classification of biomedical materials 1.2 Development history of biomedical materials 1.3 Characteristics and industrial development of biomedical materials 1.4 Applications of biomedical materials 1.5 Research progress and development trend of smart biomedical materials	3	Classroom teaching	Yuan Guangyin
2. Biocompatibility of biomaterials 2.1 Effects of biomedical materials on organism 2.2 Definition and content of biocompatibility (histocompatibility, blood compatibility, etc.) 2.3 Biocompatibility evaluation of materials	3	Classroom teaching	Pei Jia
3. Smart biomedical metallic materials with controllable degradation 3.1 Introduction to biomedical metallic materials and theoretical basis of their in vivo degradation 3.1.1 Clinical application status of traditional biomedical metallic materials 3.1.2 Main problems of traditional biomedical metallic materials 3.2 Design strategy, preparation and in vitro and in vivo study of biomedical metals with controllable degradation 3.2.1 Design, preparation, fundamental research and clinical applications of controllable biodegradation magnesium-	12	Classroom teaching + Experiment	Yuan Guangyin

	based materials 3.2.2 Design, preparation, fundamental research and clinical applications of controllable biodegradation zinc-based materials 3.3 Biomedical metallic materials degradation and cytocompatibility experiments			
	4. Advanced functional bioceramic materials 4.1 Inert Bioceramics 4.2 Bioactive ceramics 4.3 Smart piezoelectric bioceramics	3	Classroom teaching	Pei Jia
	5. Smart biomedical polymer hydrogel materials 5.1 Introduction to biomedical polymer hydrogel (2 hours) 5.2 Design, structure and function of smart biomedical polymer hydrogel (4 hours) 5.3 Functions of smart biomedical polymer hydrogel materials (3 hours) 5.4 Biomedical applications of polymer hydrogel materials (4 hours) 5.5 Preparation and characterization of biomimetic hydrogel (2 hours)	15	Classroom teaching + Experiment	Feng Chuanliang
	6. Biomaterials interfaces and smart functional coatings (6 class hours) 6.1 Interaction of protein/cell and biomaterials (3 class hours) 6.1.1 Protein structures, functions and protein adsorption 6.1.2 Cell membrane structure, recognition and cell adhesion 6.1.3 Effect of biomaterial interfaces on protein and cell behaviors 6.2 Design and applications of biofunctional interfaces (3 class hours) 6.2.1 Bioactive bionic surface and interface 6.2.2 Anti bioadhesive surface 6.2.3 Smart drug delivery coatings	6	Classroom teaching	Pei Jia
	7. Artificial organs, tissue engineering and smart materials for regeneration and repair 7.1 Introduction to artificial organs and tissue engineering 7.2 Regenerative repair materials and their research progress 7.3 Design, structure and applications of tissue engineering scaffold for tissue-inducing regeneration	3	Classroom teaching	Pei Jia
	8. Biological 3D printing technology 8.1 Introduction to 3D printing and its current technical progress (1 class hour) 8.2 Applications of 3D printing technology in biomedicine (2 class hours)	3	Classroom teaching + Group discussion and reports	Yuan Guangyin
*课程要求（中文） Requirements	（课程考核方式、考核标准等；不少于 50 字） 考核方式及标准为：课后作业、课堂小测验 (2 次，10%+10%)、小组 ppt 主题报告（1 次，10%）、小组实验报告（2 次，10%+10%）、期末考试（50%）。			

*课程要求 （English） Requirements	（须与中文一致，翻译请力求信达雅。） The course assessment methods and standards are: homework, classroom quiz (2 times, 10% + 10%), group theme report (1 time, 10%), group experiment report (2 times, 10% + 10%), final exam (50%).
课程资源 （中文） Resources	（教材、教参、网站资料等。） 1. 生物材料科学：医用材料导论（原著第2版）（中文版）， [美] 巴迪·D·拉特纳 等著，科学出版社或清华大学出版社； 2. 凝胶化学，顾雪蓉，朱育平著，化学工业出版社； 3. 腐蚀电化学原理，曹楚南编著，3版，北京：化学工业出版社，2008.2； 4. Biointerfaces: Where Material Meets Biology（英）， Dietmar Hutmacher, Wojciech Chrzanowski编著，RSC出版社 Smart Materials Series 2014。
课程资源 （English） Resources	（须与中文一致，请力求信达雅。） 1. Biomaterials Science：An Introduction to Materials in Medicine (Second Edition) (Chinese version), by Buddy D Ratner, Science Press or Tsinghua University Press. 2. Gel Chemistry, by Gu Xuerong and Zhu Yuping, Chemical Industry Press. 3. Principles of Electrochemical Corrosion, by Cao Chunan, 3rd Edition, Beijing: Chemical Industry Press, 2008.2. 4. Biointerfaces: Where Material Meets Biology, by Dietmar Hutmacher, Wojciech Chrzanowski，RSC Publishing Smart Materials Series 2014.
备注 Note	