The Biomedical Engineering (BME) Program

■ Program Overview

The Biomedical Engineering (BME) Program was first established at SJTU in 1979. After more than 30 years of rapid development, the School of BME was formally established. The BME program of SJTU has been ranked consistently in the top three in China and has the following unique advantages to support its rapid development into a world-class BME discipline: SJTU is very strong not only in engineering and physical sciences that have had a history over 100 years, but also in the ranked #1 clinical medicine with 12 top ranked affiliated hospitals in China. BME at SJTU has the following divisions:Biomedical Instrumentation, Neuroengineering, Medical Imaging and Informatics, Biological Sciences, Nano Biomaterial and Systems Biology and Medicine.

■ Main Courses

序号	课程名称（中文）	课程名称（英文）	授课教师	课程简介
1	神经运动控制	Neural Control of Movements	LAN Ning	Neural Control of Movement is a basic function of human brain. Movement is essential to our ability to stand, walk and manipulate, which are necessary to maintain our life. Thus, motor control is the ability to regulate or direct neuromechanical mechanisms to perform desired tasks (goal-directed). Electrical stimulation is a fundamental technique to interact with the nervous system. This course will cover the principle of electrical activation of neural tissue, as well as its application to the rehabilitation of motor functions. The purpose of this course is to provide graduate students a body of knowledge to understand neural control of movement, and to develop assistive devices or training paradigms for people with motor disabilities.
2	生物医学光子学	Biomedical Optics	WEI Xunbin	In this class, we will teach the students the knowledge of the interaction of light with biological materials, where light includes all forms of radiation energy whose 3quantum unit is the photon. The students will learn how biomedical optics is used in biological science to image, analyze and manipulate living organism at cellular and molecular level in a minimally or non-invasive manner. The students will also learn how biomedical optics is used in medicine to study tissue and blood at the macro and micro organism level to detect, diagnose and treat diseases in a way that is non-invasive to the body.
3	生物医学信号处理	Biomedical Signal Processing	TONG Shanbao,SUN Junfeng	This course will cover a wide range of signal and data processing techniques in biomedical engineering, including the signal requisition, removing noises, filtering, pre-processing, linear, nonlinear, network, parametric modeling, statistical analysis, bivariate, multivariate analysis and etc.
4	高级生物医学图像处理	Advanced Digital Image Processing	GU Lixu	This lecture is designed for graduated students (Mater/PhD) who want to learn advance theory, algorithms and its applications on the digital image processing area. The contents may include image acquiring, image filtering, image segmentation, image

				understanding and visualization. It could help students to review the history, current status and development of the research area, and could help them to apply them to their own research field.
5	生物传热传质学	Bioheat and Mass transfer	ZHANG Aili	This course is designed for students in biomedical engineering. The course will introduce basic bio-heat and mass transfer theories and methods. Analysis and modeling of the bio-transport processes in different levels are included. Advanced application of bioheat and mass transfer in clinic such as hyperthermia, high temperature ablation of tumor, cryosurgery, cryopreservation, burn evaluation and the techniques related will be discussed and studied. Through learning of this course, students shall be able to use the basic heat and mass theories and modeling methods to analyze and solve real problems in medicine.
6	神经影像学	Neuroimaging	LI Yao	The overall goal of this course is to give the students a solid background in the concepts to the common types of neuroimaging methods, their clinical applications, as well as a set of tools to analyze these images in the service of scientific hypothesis testing.
7	计算医学影像方法	Computational Methods for Medical Imaging	GAO Hao	This introductory course focuses on computational methods for medical imaging. Several imaging modalities, such as computed tomography, magnetic resonance imaging, optical imaging, and multimodality, will be used as model problems, so-called forward problems; numerical methods for solving these model problems, so-called inverse problems, will be discussed, including discretization, regularization, and optimization methods.
8	细胞生物光子学	Cell biological Photonics	HE Hao	Biophotonics is a fast-developing inter-discipline combined with advanced laser technology and biology. 9Specifically, cell biological photonics concentrate one of the most important and significant research in Biophotonics. In this course, the most exciting and significant advances on Biophotonics will be presented, including microscopy, cell surgery, and cell signaling modulation by lasers. I would like to introduce the basic principles of photons, optics, and how lasers interacting with biological cells. Students should, beyond understanding those contents, think independently about how to further and improve their research. In addition, they need to learn how to write peer-reviewed scientific papers and oral presentations of their works.
9	系统生物医学最新技术进展	Systems Biology: concepts, methodologies and applications	TAO Shengce	In this class we will teach the students what is systems biology, the basic theory, the history and the future. First, we will address the concepts of systems biology and its important branch systems biomedicine. Then we will introduce several key methodologies/technologies, such as microarrays, mass spectrometry, next generation sequencing, microfluidics and etc. The latest applications of systems biology will also be addressed along with the methodologies.
10	生物材料与组织工程	Biomaterials and Tissue Engineering	LI Haiyan	From this course, students will firstly learn the basic knowledge of biomaterials and tissue engineering, including the definitions and developments of biomaterials and tissue engineering, the category of

				biomaterials and tissue engineering, the requirements for materials to be a biomaterial, the evaluation methods of biomaterials and how the biomaterials are applied in tissue engineering. Based on the understanding of the biomaterials and tissue engineering, the students will also learn how to fabricate and characterize biomaterials and three-dimensional porous scaffolds for different types of tissues or organs engineering, including in vitro characterizations and in vivo characterizations.
11	神经调控技术	Techniques for Neuromodulation	WANG Yongting	In this course we will explore various neuromodulation techniques and their applications both in research and in clinic. We will discuss techniques such as Deep Brain Stimulation (DBS), Transcranial Magnetic Stimulation (TMS), Transcranial Electrical Stimulation (TES), Functional Electrical Stimulation (FES), and Transcranial Focused Ultrasound Stimulation (TFUS). The principle and recent applications of Optogenetics will also be discussed. Students will have chance to further their understanding of these techniques by participating in paper discussions and oral presentations.
12	生物医学工程中的计算机视觉	Computer Vision in Biomedical Engineering	WANG Qian	Briefly speaking, the purpose of computer vision is to let computers act like human beings in terms of visual perception. In the other word, computers are expected to visualize and understand this world via images, videos, etc. Computer vision has moved forward significantly during past decades. Its accomplishments are now widely applied to numerous areas including biomedical engineering. This course shall introduce basic theories of computer vision, as well as its classical solutions. Also, applications related with biomedical engineering shall be the focus in this course, for the sake of revealing the miracles of computer vision.
13	分子传感器与纳米器件：原理，设计及其在生物医学工程中的应用	Molecular Sensors and Nanodevices: Principles, Design and Applications in Biomedical Engineering	QIAN Kun, DING Xianting	§ To know the basic elements and major classes of molecular sensors, nano-devices and biomedical microsystems (or Micro-Electro-Mechanical Systems, MEMS); § To demonstrate an understanding of the fundamental principles behind the operation of molecular sensors, nano-devices and biomedical microsystems. § To understand the unique requirements, environments, and applications of molecular sensors, nano-devices and biomedical microsystems. § To gain an understanding of standard micro-nano fabrication techniques for sensors § To apply knowledge of the above to the design and manufacturing of such microsystems. The term "micro" is interpreted in its classical sense as "tiny“, including both MEMS and Nanotechnology. We will use the term “microsystems”, “microsensors”, “transducers”, “MEMS” exchangablly in this course.
14	生物医学工程前沿讲座	Frontiers in Biomedical Engineering Seminar Series	XIA Weiliang XIONG Liqin	Biomedical engineering is an interdisciplinary subject that covers biology, medicine, engineering, physical sciences and the integration of these disciplines, with an aim of solving critical health problems. In this course we will invite leading scientists from home and abroad to introduce their cutting-edge research progress in the biomedical engineering fields, which include but are not

				limited to medical instrumentation, medical imaging, neuroscience and neuroengineering, nanotechnology and tissue engineering. Speakers also share their research experiences and scientific visions that can be immensely helpful for students. Our past speakers of the course include members of Academy of Science or Engineering from China or USA, IEEE fellows, Chair professors in top universities, Chief physicians in China's best hospitals, and so on. The students are encouraged to think critically and ask questions throughout the course.