课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	**课程名称 Course Title**	生物医学工程临床认知 I Clinical Perception for Biomedical Engineering I
2.	**授课院系 Originating Department**	生物医学工程系 Department of Biomedical Engineering
3.	**课程编号 Course Code**	BMEB326
4.	**课程学分 Credit Value**	2
5.	**课程类别 Course Type**	专业选修课 Major Elective Courses
6.	**授课学期 Semester**	春季 Spring
7.	**授课语言 Teaching Language**	中英双语 English & Chinese
8.	**授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation& Contact （For team teaching, please list all instructors）**	奚磊，副教授，xilei@sustech.edu.cn Xi Lei, Associate Professor, xilei@sustech.edu.cn
9.	**实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact**	待公布 To be announced
10.	**选课人数限额(可不填) Maximum Enrolment （Optional）**	

11.	授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other（Please specify）	总学时 Total
	学时数 Credit Hours	32				32

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无 None
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite	生物医学工程临床认知Ⅱ Clinical Perception for Biomedical Engineering Ⅱ
14.	其它要求修读本课程的学系 Cross-listing Dept.	无 None

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

Using the "medical-engineering intersection" training model to introduce students to the principles and methods of medical imaging, neural engineering and rehabilitation engineering, and create a clinical platform for students to cultivate their ability to solve specific problems in the clinical environment as well as to establish a clinical thinking model.

本课程将运用“医工交叉”的培养模式，为学生介绍医学影像学、神经工程和康复工程原理、方法知识，并为学生打造接触临床教学平台，为培养其解决临床环境中的具体问题的能力，建立临床思维模式打下基础。

16. 预达学习成果 Learning Outcomes

Through the study of this course, students can master a lot of the principles of x-ray and ultrasound imaging, the basic methods of interventional therapy, the principles of central nervous system and neuro-electrophysiology, common spine diseases, bone stem cells and bone scaffolds and other basic theoretical knowledge, as well as gain clinical case analysis capabilities.

通过本课程的学习，学生可以掌握很多关于 x-ray 和超声成像的原理、介入治疗基本方法、中枢神经系统和神经电生理原理、脊柱常见疾病、骨骼干细胞和骨骼支架等基础理论知识，以及获得临床案例分析能力。

17. 课程内容及教学日历 （如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）
Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

一、**课程概况 Course Overview**：

1. 该课程主要分为医学影像学、神经工程和康复工程三个认知式教学实践模块，每个模块 2-3 位专业导师负责；（24 学时）

The course is mainly divided into three clinical perception teaching practice modules: medical imaging, neuro engineering and rehabilitation engineering. Each module is responsible for two professional instructors;

2. 邀请一线临床医师开展讲座。（8 学时）

Invite experienced first-line clinicians to give lectures.

二、**课程模块设置 Course Module Setting**：

医学影像 Medical Imaging：

医学影像模块以信号与系统，医学影像系统原理为理论基础，以成像技术为实践基础进行轮转，包含 X-ray 介入和 ultrasound 两个部分。

The medical imaging module is based on the theory of signals and systems, the principles of medical imaging systems, and rotates on the basis of imaging technology, including X-ray intervention and ultrasound.

(专业导师：奚磊、唐建波、一线临床医生团队 Instructor: Xi Lei, Tang Jianbo, frontline clinician team)

Lecture 1: X-ray 物理基础 X-ray Imaging System Principle （2 学时）

介绍 X-ray 产生机制、X-ray 与人体相互作用机制、X-ray 探测原理

To introduce X-ray generation mechanism, X-ray interaction mechanism with human body, X-ray detection principle, DSA principle and application, CT principle and image reconstruction

Lecture 2: DSA 系统原理与应用 Principle and Application of Digital Subtraction Angiography（（2 学时）

介绍 DSA 系统原理、成像机制及临床应用

To introduce the principle, imaging mechanism and clinical application of DSA system

Lecture 3: 超声物理原理 Principles of Ultrasound Imaging （2 学时）

介绍振动与波的基本知识、声波产生机理、超声成像原理

To introduce sound wave generation mechanism, ultrasonic imaging principle, ultrasonic transducer, new ultrasonic

imaging equipment

Lecture 4: 超声物理原理 Principles of Ultrasound Imaging （2 学时）

介绍超声换能器、超声成像设备以及新型超声成像技术

To introduce ultrasound transducers, ultrasound imaging equipment and new ultrasound imaging technologies

Lecture 5: X-ray 及超声成像临床现状 Clinical Status of X-ray and Ultrasound Imaging （2 学时）

临床医生介绍 X-ray 及超声成像在临床中的应用背景、现状、经典病例以及亟需解决的问题

Clinicians introduce the application background, current situation, classic cases and urgent problems of X-ray and ultrasound imaging in clinical practice

神经工程 Neural Engineering：

神经工程模块系统连贯定量生理学，机器学习与神经工程等理论知识，并以神经类疾病为基础进行轮转，包含神经影像处理、脑功能评估、神经外科手术见习、外周神经功能等模块。

The neural engineering module is consistent with quantitative physiology, machine learning and neural engineering and other theoretical knowledge, and is based on neurological diseases, which include neurorehabilitation and neurosurgery. It involves neuroimaging processing and brain function assessment, neurosurgery training and other modules.

(专业导师：刘泉影、陈放怡、一线临床医生团队 Instructor: Liu Quanying, Chen Fangyi, frontline clinician team)

Lecture 1: 中枢神经系统原理 Central Nervous System Principle （1 学时）

介绍中枢神经系统，包括视觉、听觉等感知觉系统原理，神经运动控制原理，情绪调节的相关脑区等，及大脑相关疾病的神经机制

To introduce the central nervous system, including the principles of vision, hearing and other sensory systems, the principles of neuromotor control, the related brain areas of emotion regulation, and the neural mechanisms of brain-related diseases

Lecture 2: 神经电生理及其临床应用 Neuro-electrophysiology and Clinical Application（2 学时）

介绍神经电生理原理，包括神经电生理信号采集系统、神经电信号分析算法；介绍神经电生理在临床诊断中的应用

To introduce the principles of neuro-electrophysiology, including neuro-electrophysiological signal acquisition system, neuroelectric signal analysis algorithm; to introduce the application of neuro-electrophysiology in clinical diagnosis

Lecture 3: 脑影像处理及其临床应用 Brain Image Processing and Clinical Application（2 学时）

介绍脑影像技术，包括 MRI、PET、fMRI 的成像原理，信号处理流程，及其临床应用

To introduce brain imaging technology, including MRI, PET, fMRI imaging principles, signal processing procedures, and clinical applications

Lecture 4: 耳解剖结构原理 Principles of Ear Anatomy（1 学时）

介绍外耳道形态、鼓膜结构、中耳、内耳迷路和内外淋巴、耳蜗结构和频率选择性、毛细胞生理和遗传

To Introduce the external auditory canal morphology, tympanic membrane structure, middle ear, inner ear labyrinth and inner and outer lymph, cochlear structure and frequency selectivity, hair cell physiology and heredity

Lecture 5: 听觉神经通路原理 Principle of Auditory Nerve Pathway（2 学时）

介绍听觉毛细胞突触传递特性、听觉中枢神经递质和听觉信号处理（声源定位、声调识别）、听觉皮层功能及可塑性

To introduce the synaptic transmission characteristics of auditory hair cells, central auditory neurotransmitter and auditory signal processing (sound source localization, tone recognition), auditory cortex function and plasticity

Lecture 6: 耳鼻喉临床诊疗 Clinical Diagnosis and Treatment of ENT（2 学时）

介绍临床听觉检测方法：纯音测听、听觉脑干相应（ABR）、声阻抗（单频+宽频）和 DPOA；耳科手术介绍：耳内镜下鼓膜修复、中耳植入、耳蜗植入和小耳整形

To introduce the clinical auditory testing methods: pure tone audiometry, auditory brainstem response (ABR), acoustic impedance (single frequency + broadband) and DPOA, and introduce the otological surgery: endoscopic tympanic membrane repair, middle ear implantation, cochlear implantation and small ear plastic surgery

康复工程 Rehabilitation Engineering：

康复工程模块涵盖理论力学，生物力学理论知识框架，以运动康复为实践训练着重点，包含手术外科康复、物理运动康复、神经调控康复，康复辅具及器械四部分。

The rehabilitation engineering module covers theoretical mechanics and biomechanics theoretical knowledge framework, with sports rehabilitation as the focus of practical training, including surgical and surgical rehabilitation, physical sports rehabilitation, neuro regulation rehabilitation, rehabilitation aids and equipment.

(专业导师：唐斌、刘超、张明明、一线临床医生团队 Instructor: Tang Bin, Liu Chao, Zhang Mingming, frontline clinician team)

Lecture 1: 脊柱常见疾病及临床应对 Common Spine Diseases and Clinical Response（2 学时）

介绍常见的脊柱疾病病理，发病机制及相应的生物医学工程手段在临床上的应用，包括各类相关医疗器械、药物、生物材

料等

To introduce the pathology and pathogenesis of common spinal diseases and the clinical application of corresponding biomedical engineering methods, including various related medical devices, drugs, biological materials, etc.

Lecture 2: 骨骼组织再生原理 Principles of Bone Tissue Regeneration（2 学时）

介绍骨骼组织再生中的细胞和分子机制、现有临床手段、相关的医疗器械

To introduce the cellular and molecular mechanisms of bone tissue regeneration, current clinical practices, and related medical devices

Lecture 3: 骨骼支架及临床应用 Bone Scaffolds and Their Clinical Applications（2 学时）

介绍骨骼界面支架，包括材料选择、生物力学、以及临床的考虑

Overview of bone-interfacing scaffolds, including material choice, biomechanics, and clinical considerations

Lecture 4: 骨科和创伤的临床案例及工程解决方案 Orthopaedic and Trauma Clinical Cases and Their Engineering Solutions（2 学时）

介绍常见骨科临床案例、目前的挑战、讨论相关的生物医学工程解决方案

To introduce common clinical cases in orthopaedics, current challenges, and discuss relevant biomedical engineering solutions

Lecture 5: 神经损伤及康复原理 Principles of Nerve Injury and Rehabilitation （2 学时）

介绍面向神经损伤的临床康复手段，康复机器人类别、原理、功能及应用

To introduce clinical rehabilitation techniques for patients with neurological injuries, types of rehabilitation robots, as well as their principles, functions and applications

Lecture 6: 神经康复机器人及其临床应用 Neurological Rehabilitation Robot and Clinical Application（2 学时）

介绍神经康复机器人发展的现状，临床效果、局限性及发展趋势

To introduce the development status, clinical efficacy, limitations, and trends of rehabilitation robots

18. 教材及其它参考资料 Textbook and Supplementary Readings

待公布 To be announced

课程评估 ASSESSMENT

19.

评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		10		
课堂表现 Class Performance				
小测验 Quiz				
课程报告 Reports		60		
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		30		
其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)				

20. 记分方式 GRADING SYSTEM

☑A. 十三级等级制 Letter Grading
☐B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过
This Course has been approved by the following person or committee of authority