

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	智能医学工程综合实验 I Experiment on Intelligence Medical Engineering I
1	授课院系 Originating Department	生物医学工程系 Biomedical Engineering
3.	课程编号 Course Code	BMEB328
B	课程学分 Credit Value	2
5.	课程类别 Course Type	专业核心课 Major Core Courses
6.	授课学期 Semester	秋季 Fall
7.	授课语言 Teaching Language	英文 English
8.	授课教师、所属学系、联系方式 Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	彭诚, 高级实验师, pengc@sustech.edu.cn 杨用, 高级实验师, yangy9@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	习题/辅导/讨论	实验/实习	其它(请具体注明)	总学时
	Lectures	Tutorials	Lab/Practical	Other (Please specify)	Total
学时数 Credit Hours			64		64
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	智能医学工程实验 II Experiment on Intelligence Medical 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

智能医学工程是指以现代医学与生物学理论为基础，融合先进的脑认知、大数据、云计算、机器学习等人工智能及相关领域工程技术，研究人的生命和疾病现象的本质及其规律，探索人机协同的智能化诊疗方法和临床应用的新兴交叉学科。作为一门交叉度很高的学科，智能医学工程课程相关的实践课程涉及不同领域的各个方面。在本课程中，我们将整合相关课程中的各类实验实践教学内容，指导学生开展相关的教学实验。通过本课程的学习，学生将进一步巩固理解相应理论课的基础知识，并拓展其应用场景，培养相应的动手能力及时间能力，为学生未来从事科学研究或产业开发实践工作打下坚实基础。

Intelligent medical engineering refers to the integration of advanced brain cognition, big data, cloud computing, machine learning and other artificial intelligence and related field engineering technologies based on modern medicine and biological theories to study the nature and the nature of human life and disease phenomena、Laws, to explore the intelligent diagnosis and treatment methods of human-machine collaboration and the emerging cross-disciplines of clinical application. As a subject with a high degree of intersection, the practical courses related to the intelligent medical engineering course involve all aspects of different fields. In this course, we will integrate various experimental and practical teaching contents in related courses and guide students to carry out related teaching experiments. Through the study of this course, students will further consolidate and understand the basic knowledge of corresponding theoretical courses, expand their application scenarios, cultivate corresponding hands-on and time skills, and lay a solid foundation for students to engage in scientific research or industrial development practical work in the future.

16. 预达学习成果 Learning Outcomes

通过本课程的学习，熟练掌握智能医学监控，生物医学仪器，医学数据和机器学习等各个不同智能医学相关领域的学科基础知识和技能，尤其在动手能力及实际操作能力上有明显的提高。同时，结合相应理论知识，做到对知识技能的活学活用，为未来进入相关科研或产业领域的实际工作技能学习奠定坚实基础。

Through the study of this course, you will be proficient in the basic knowledge and skills of various intelligent medical engineering related fields such as intelligent medical monitoring, biomedical instruments, medical data and machining, etc., especially in the practical ability and practical operation capability. At the same time, combined with the corresponding theoretical knowledge, the knowledge and skills learnt can lay a solid foundation for the practical work skills learning in the relevant scientific research or industrial fields in the future.

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.)

本课程分为上下两个学期开展。第一学期主要内容为生物医学仪器模块、医学数据和机器学习模块；第二学期的主要内容为智能医学监控技术模块，医学机器人模块。具体的实验课内容及安排如下：

模块一：生物医学仪器模块：Module I. Bioinstrumentation

第 1 课 （4 学时）：生物医学仪器; Bioinstrumentation - Procedure (1)&(2)

- ✧ Procedure 1: 正相放大器/反相放大器; Non-Inverting or Inverting Amplifier
- ✧ Procedure 2: 用仪用放大器测量进行差分测量; Instrumentation Amplifier for Differential Measurement

第 2 课 （4 学时）：生物医学仪器; Bioinstrumentation - Procedure (3)&(4)&(5)

- ✧ Procedure 3: 三运放仪用放大器; Three-amp instrumentation amplifier
- ✧ Procedure 4: RC 滤波器 - 无源低通滤波器; RC Filter - Passive Low Pass Filter
- ✧ Procedure 5: RC 滤波器 - 无源带通滤波器; RC Filter - Passive Bandpass

第 3 课 （4 学时）：生物医学仪器; Bioinstrumentation - Procedure (6)&(7)

- ✧ Procedure 6: 有源放大器 - 带通滤波器; Active filter - bandpass
- ✧ Procedure 7: 心电图测量; Electrocardiogram Measurement

第 4 课 （4 学时）：生物医学仪器; Bioinstrumentation - Procedure (7) cont.

- ✧ Procedure 7: 心电图测量; Electrocardiogram Measurement

第 5 课 （4 学时）：生物医学仪器; Bioinstrumentation - Procedure (7) cont.

- ✧ Procedure 7: 心电图测量; Electrocardiogram Measurement

第 6 课 （4 学时）：生物医学信号采集和处理; Biosignal Acquisition and Processing - Procedure (1)

- ✧ Procedure 1: 心电信号处理、Matlab GUI; ECG Signal Processing and Acquisition GUI

第 7 课 （4 学时）：生物医学信号采集和处理; Biosignal Acquisition and Processing - Procedure (2)

- ✧ Procedure 2: 用自行设计的 GUI 检测人体 ECG 信号; Using Your GUI to Measure ECG from a Human Subject

第 8 课 （4 学时）：生物医学信号采集和处理; Biosignal Acquisition and Processing - Procedure (2) cont.

- ✧ Procedure 2: 用自行设计的 GUI 检测人体 ECG 信号; Using Your GUI to Measure ECG from a Human Subject

模块二：医学数据和机器学习. Module II. Medical data and machine learning

第 9 课 （4 学时）：Python 语言实现分类器和回归模型; Implementation of classifier and regression model with Python

第 10 课 （4 学时）：脑电信号处理：独立成分分析 + ERP 分析; EEG signal processing: independent component

analysis + ERP analysis

第 11 课 (4 学时): 核磁共振脑影像数据集获取与预处理: bias correction, alignment, movement correction, normalization 等; MRI brain images acquisition and pre-processing: bias correction, alignment, movement correction, normalization, etc.

第 12 课 (4 学时): 信号特征提取及可视化; Feature extraction and visualization

第 13 课 (4 学时): 深度学习模型 1——卷积神经网络. Deep learning model I -- CNN

第 14 课 (4 学时): 深度学习模型 2——循环神经网络. Deep learning model II - RNN

第 15 课 (4 学时): 深度学习模型用于疾病分类 Deep learning model for disease classifications

第 16 课 (4 学时): 项目展示; Final presentation

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

教材采用教研组自编实验手册。

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		10%		
小测验 Quiz		0%		
课程项目 Projects		0%		
平时作业 Assignments		60%		
期中考试 Mid-Term Test		0%		
期末考试 Final Exam		0%		
期末报告 Final Presentation		10%		
其它 (可根据需要 改写以上评估方 式) Others (The above may be modified as necessary)		10%		



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

生物医学工程系教学委员会

