南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

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 II Experiment on Intelligence Medical Engineering II
I	**授课院系 Originating Department**	生物医学工程系 Biomedical Engineering
3.	**课程编号 Course Code**	BMEB329
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**	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）**	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 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			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	无 None
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实践能力，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 (IME) is an emerging interdisciplinary filed, which integrates advanced cognition, big data, cloud computing, machine learning and other artificial intelligence related technologies, based on modern medicine and biological theories to study the nature of human life and diseases, to investigate the intelligent diagnosis and treatment methods of human-machine collaboration. Therefore, the practical courses of IME involve various theories and technologies from related disciplines.

In this two-semester series practical courses, the students will experience integrated practical procedures of the topics covered in the related courses in the IME fields, such as intelligent medical monitoring, biomedical instrumentations, medical data and machining learning, and medical robotics.

After the study in this course, students will consolidate and further understand the basic knowledge of corresponding fields, gain experiences in the applications, master corresponding hands-on skills, which lays 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

通过本系列课程的学习，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践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。

After the two-semester series practical courses, the students will get practical skills in various intelligent medical engineering related fields such as intelligent medical monitoring, biomedical instrumentations, medical data and machining learning, and medical robotics. Meanwhile, 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.)

《智能医学工程综合实验》系列课程分为上下两个学期开展。第一学期《智能医学工程综合实验 I》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《智能医学工程综合实验 II》主要内容为智能医学监控模块，医学机器人模块。具体的实验课内容及安排如下：

模块三：智能医学监控

第 1 课 （4 学时）温度传感器认知与应用 Temperature Sensor Cognition and Applications

讲解热电式测温传感器、红外测温传感器以及基于热敏电阻的测温传感器原理等，完成体温实时监测系统的设计。To introduce the principles of thermoelectric temperature sensor, infrared temperature sensor and thermistor temperature sensor, and design the real-time temperature monitoring system.

第 2 课 （4 学时）红外血氧实时监控 Real-time Blood Oxygen Monitoring

讲解血氧饱和度测量原理，主要包括郎伯比尔定律和光电容积脉搏波检测法等。To introduce the principle of oxygen saturation of blood measurement, including Beer-Lambert law and photoelectric volumetric pulse wave detection, etc.

第 3 课 （4 学时）基础知识及环境搭建：Linux 指令学习，C/C++复习，使用开发板读取并传输图像 Linux and C/C++ learning, use the development board to read and transfer images

第 4 课 （4 学时）根据像素运动提取呼吸信号：Respiration signal extraction based on pixel flow

讲解从图像中提取像素运动信号的原理，推导数学模型，讲解数学模型在 C/C++中的实现等。To introduce methods to extract pixel motion signals from images, derive mathematical models and introduce the implementation of mathematical models in C/C++, etc.

第 5 课 （4 学时）rPPG 提取心率信号；Heart rate extraction based on rPPG

讲解 rPPG 技术的原理，介绍频谱分析技术及其在 C/C++中的实现等。To introduce the principles of rPPG technology, introduce spectrum analysis technology and its implementation in C/C++, etc.

第 6 课 （4 学时）葡萄糖电化学传感器与血糖测定： Application of electrochemical biosensor for glucose detection

讲解葡萄糖电化学传感器的工作原理、制备过程及用于葡萄糖浓度的测定等。To introduce the working principle、the fabrication, and the application of glucose biosensor.

第 7 课 （4 学时）导电墨水与可穿戴传感器： Application of conductive polyaniline ink for the fabrication of wearable sensor

讲解导电墨水的制作过程以及如何利用导电墨水制作传感器等。 To introduce the production of conductive polyaniline ink and the application of conductive polymers to construct sensors responding to mechanical strains or ambient chemical species.

第 8 课 （4 学时）展示与汇报 Presentation

模块四：医学机器人. Module IV. Medical Robotics

第 9 课 （4 学时）实验范式设计：视觉刺激范式设计与实现 Experimental paradigm design: visual stimulus paradigm

design and implementation

第 10 课 （4 学时）脑电信号采集系统构建：实现单导联或多导联脑电信号采集 Construction of EEG signal acquisition system: implement single-lead or multi-lead EEG signal acquisition

第 11 课 （4 学时）诱发脑电实验：特定刺激范式下，脑电信号的采集 Evoked potential experiment: acquisition of evoked potentials by a specific stimulus paradigm

第 12 课 （4 学时）信号分析与模式识别：对前述诱发脑电信号进行分析、模式识别与分类 Signal analysis and pattern recognition: analysis, pattern recognition and classification of the evoked potential signals

第 13 课 （4 学时）脑控机器人环境搭建：实现通过脑电信号模式控制机器人运行 Brain-controlled robot environment construction: implement the control of robot operation by evoked potentials

第 14 课 （4 学时）系统整体调试：进行性能验证与分析 Overall system testing: performance verification and analysis

第 15 课 (4 学时）系统实测和优化：改进系统性能 Online testing and optimization: improve the system performance

第 16 课 (4 学时）系统实测和比赛 System presentation and competition

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