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**	**机器人感知与智能 / Robotic Perception and Intelligence**
2.	**授课院系 Originating Department**	电子与电气工程系
3.	**课程编号 Course Code**	EE 211
4.	**课程学分 Credit Value**	3
5.	**课程类别 Course Type**	专业选修课 Major Elective Courses **（请保留相应选项 Please only keep the relevant information）**
6.	**授课学期 Semester**	秋季 Fall
7.	**授课语言 Teaching Language**	英语 English **（请保留相应选项 Please only keep the relevant information）**
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）**	王建坤 电子与电气工程系 wangjk@sustech.edu.cn 18253162298
9.	**实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact**	待公布 To be announced **（请保留相应选项 Please only keep the relevant information）**
10.	**选课人数限额(可不填) Maximum Enrolment （Optional）**	30

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 Nane
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	EE368 机器人运动与控制方法、EE346 移动机器人导航与控制 EE368 Robotic Motion and Control; EE346 Mobile Robot Navigation and Control
14. 其它要求修读本课程的学系 Cross-listing Dept.	计算机系、机械系

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程旨在

（1）介绍机器人常用的传感器及工作原理，包括惯性传感、GPS 和里程计，用于导航和抓取任务的 3D 视觉，视觉伺服，多传感器数据融合；

（2）介绍用于不同机器人任务的智能规划算法；

（3）介绍常用的机器人学习算法。

This course aims to

(1) introduce the commonly used sensors and their working principles in robots, including inertial sensing, GPS and odometry, 3D vision for navigation and grasping tasks, visual servoing, and multi-sensor data fusion;

(2) introduce the intelligent planning methods in different robot tasks;

(3) introduce the commonly used robot learning algorithms.

16. 预达学习成果 Learning Outcomes

通过本课程的学习，学生可以

（1）了解常见传感器的工作原理；

（2）了解基本的机器人运动与路径规划算法；

（3）了解基本的机器人学习算法；

（4）通过小组合作，运用机器人感知与智能，完成一个具体的机器人任务。

To the end of this course, students should

(1) understand the working principle of common sensors;

(2) understand basic robot motion and path planning algorithms;

(3) understand basic robot learning algorithms;

(4) use robotic perception and intelligence to complete a specific robot task through teamwork.

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.)

Lecture 1: Introduction to robotic perception and intelligence.

(1) Conventional robotic perception and intelligence algorithms.

(2) Current developments in robotic perception and intelligence.

Lab Practice 1.

Lecture 2: Trajectory Generation.

(1) Point-to-Point Trajectories.

(2) Polynomial Via Point Trajectories.

(3) Time-Optimal Time Scaling.

Lab Practice 2.

Lecture 3: Motion Planning.

(1) Overview of Motion Planning.

(2) Foundations.

(3) Complete Path Planners.

(4) Grid Methods.

(5) Virtual Potential Fields

Lab Practice 3.

Lecture 4: Basic Search Methods.

(1) Shortest Path Problems.

(2) Uniform-cost Search.

(3) Greedy Search.

(4) Optimal Search.

Lab Practice 4.

Lecture 5: Sampling-based Methods.

(1) Probabilistic Roadmap.

(2) Rapidly-exploring Random Tree.

Lab Practice 5.

Lecture 6: Advanced Planning Methods.

(1) Nonlinear Optimization.

(2) Smoothing.

(3) Other advanced methods.

Lab Practice 6.

Lecture 7: Inertial Sensing, GPS and Odometry.

(1) Odometry.

(2) Gyroscopic Systems.

(3) IMU Packages.

(4) Satellite-based Positioning.

(5) GPU-IMU Integration.

Lab Practice 7.

Lecture 8: Range Sensing and Vision Sensing.

(1) Range Sensing Technologies.

(2) Vison System.

Lab Practice 8.

Lecture 9: Multi-sensor Data Fusion.

(1) Multi-sensor Data Fusion Methods.

(2) Multi-sensor Fusion Architectures.

(3) Applications.

Lab Practice 9.

Lecture 10: Probability Distributions.

(1) Binary Variables.

(2) Multinomial Variables.

(3) The Gaussian Distribution.

Lab Practice 10.

Lecture 11: Sampling Methods.

(1) Basic Sampling Algorithms.

(2) Markov Chain Monte Carlo.

Lab Practice 11.

Lecture 12: Markov Models.

(1) Markov Models.

(2) Hidden Markov Models.

Lab Practice 12.

Lecture 13: Filters.

(1) Bayes Filters.

(2) The Kalman Filter.

(3) The Extended Kalman Filter.

Lab Practice 13.

Lecture 14: Learning from Humans. (To be Determined)

(1) Learning of Robots.

(2) Algorithms to Learn from Humans.

Lab Practice 14.

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

(1) Siciliano, B., and O. Khatib. "Springer handbook of robotics." (2016).

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		5		
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects		30		
平时作业 Assignments		25		
期中考试 Mid-Term Test				
期末考试 Final Exam		40		
期末报告				

Final Presentation				
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