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.

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| 1. | 课程名称 Course Title | **机器人应用与创新**<br>**Application and Innovation of Robotics** |
| 2. | 授课院系<br>Originating Department | 机械与能源工程系<br>Department of Mechanical and Energy Engineering |
| 3. | 课程编号<br>Course Code | ME431 |
| 4. | 课程学分 Credit Value | 3 |
| 5. | 课程类别<br>Course Type | 专业选修课 Major Elective Courses |
| 6. | 授课学期<br>Semester | 春季/秋季学期<br>Spring/Fall |
| 7. | 授课语言<br>Teaching Language | 中英双语<br>Chinese-English bilingual |
| 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）<br>Instructor(s), Affiliation& Contact （For team teaching, please list all instructors） | 柯文德<br>机械与能源工程系<br>13809883997<br>Wende Ke<br>Department of Mechanical and Energy Engineering<br>13809883997 |
| 9. | 实验员/助教、所属学系、联系方式<br>Tutor/TA(s), Contact | 待公布 To be announced |
| 10. | 选课人数限额(可不填)<br>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 | | 64 |

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| 12. | 先修课程、其它学习要求<br>Pre-requisites or Other Academic Requirements | ME306 机器人基础 或者 ME331 机器人建模与控制<br>ME306 Fundamentals of Robotics or ME331 Robot Modeling and Control |
| 13. | 后续课程、其它学习规划<br>Courses for which this course is a pre-requisite | |
| 14. | 其它要求修读本课程的学系<br>Cross-listing Dept. | |

## 教学大纲及教学日历 SYLLABUS

### 15. 教学目标 Course Objectives

《机器人应用与创新》是机器人工程专业的专业选修课程，其教学目标是介绍机器人技术创新思维与方法，结合特定行业下的问题解决，构建包括水下机器人、空中机器人、空间机器人、农林机器人、建筑机器人等，进行需求分析、原理分析、可行性方案设计与对比、机器人建模与控制、测试与应用等一系列环节，开展理论知识与实际项目结合的教学，并设计开发满足特定行业需求的机器人系统。

该课程通过对机器人应用与创新技术的讲解，结合前沿技术发展趋势，让学生对机器人技术的发展趋势形成系统性了解，掌握相关的原理与方法，培养学习兴趣，提高分析问题和解决问题的能力，为未来从事该领域的理论和应用研究打下坚实的基础。

Application and Innovation of Robotics is a professional elective course for robotics engineering specialty. Its teaching goal is to introduce the innovative thinking and methods of robotics technology. Combining with the problem solving in specific industries, it builds a system including underwater robots, aerial robots, space robots, agricultural and forestry robots, building robots, etc. It carries out demand analysis, principle analysis, feasibility design and alignment. A series of links, such as ratio, robot modeling and control, testing and application, are carried out to teach the combination of theoretical knowledge and practical projects, and to design and develop robotic systems to meet the needs of specific industries.

By explaining the application and innovation technology of robots and combining with the development trend of advanced technology, the course enables students to form a systematic understanding of the development trend of robotics technology, master relevant principles and methods, cultivate interest in learning, improve the ability of analyzing and solving problems, and build a solid foundation for future theoretical and applied research in this field.



### 16. 预达学习成果 Learning Outcomes

《机器人应用与创新》课程通过系统性讲授机器人研究过程中的创新性思维，阐述机器人的行业应用特点及方法，并采用课程分组项目同步推进课程学习。学生将掌握机器人技术创新思维模式与方法，并了解满足相关行业应用的各种机器人原理、结构、控制方法，提高问题分析能力和解决能力，开发出满足特定行业要求的机器人样机作品，提高专业学习能力和逻辑思维能力，进而培养国际化思维以及团队协作管理复合能力，为未来从事该领域的理论和应用研究，培养兴趣并打下坚实的基础。

Application and Innovation of Robotics introduces the innovative thinking in robot research and introduces the industrial application characteristics and methods of robots. Through course grouping project, the course learning is simultaneously promoted. Students will master the innovative thinking mode and method of robotics technology, and understand the principles, structures and control methods of robots that meet the needs of relevant industries. These will help to improve students' professional learning ability and logical thinking ability, cultivate their international thinking and team cooperation management ability, and build a solid foundation for future theoretical and applied research in this field.

**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.)**

| Section | 内容 Contents |
|---|---|
| 1（2 课时）<br>1 (2 hours) | 机器人设计的创新性思维及伦理<br>Innovative thinking and ethic in robot design |
| 2（2 课时）<br>2 (2 hours) | 水下机器人<br>Underwater vehicle |
| 3（2 课时）<br>3 (2 hours) | 空中机器人<br>Aerial robot |
| 4（2 课时）<br>4 (2 hours) | 空间机器人与系统<br>Space robot and system |
| 5（2 课时）<br>5 (2 hours) | 农林机器人<br>Agriculture and forestry robot |
| 6（2 课时）<br>6 (2 hours) | 建筑机器人<br>Construction robot |
| 7（2 课时）<br>7 (2 hours) | 危险作业机器人<br>Dangerous operating robot |
| 8（2 课时）<br>8 (2 hours) | 采矿机器人<br>Mining robot |
| 9（2 课时）<br>9 (2 hours) | 搜救机器人<br>Search and rescue robot |
| 10（2 课时）<br>10 (2 hours) | 智能车辆<br>Intelligent vehicle |
| 11（2 课时）<br>11 (2 hours) | 医疗机器人与计算机集成手术<br>Medical robot and computer integrated surgery |
| 12（2 课时）<br>12 (2 hours) | 类人机器人<br>Humanoid robot |
| 13（2 课时）<br>13 (2 hours) | 人-机器人物理交互中的安全性<br>Security in human-robot physical interaction |

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| 14（2 课时）<br>14 (2 hours) | 基于生物学启发的机器人<br>Robots Based on Biological Enlightenment |
| 15（2 课时）<br>15 (2 hours) | 神经机器人学：从视觉到动作<br>Neurorobotics: from vision to action |
| 16（2 课时）<br>16 (2 hours) | 项目答辩<br>Dissertation of projects |

**实验 Experiments**

1. 水下机器人设计（1）：问题分析与功能构造（第 1、2 周，4 节课）
1. Underwater vehicle(1): problem analysis and function construction (week 1,2. 4 hours)

2. 水下机器人设计（2）：结构设计（第 3、4 周，4 节课）
2. Underwater vehicle(2): structure design (week 3、4. 4 hours)

3. 水下机器人设计（3）：运动控制（第 5、6 周，4 节课）
3. Underwater vehicle(3): movement control (week 5、6. 4 hours)

4. 水下机器人设计（4）：样机测试（第 7、8 周，4 节课）
4. Underwater vehicle(3): prototype testing (week 7, 8. 4 hours)

5. 基于生物学启发的机器人：问题分析与功能构造（第 9、10 周，4 节课）
5. Robots Based on Biological Enlightenment : problem analysis and function construction (week 9, 10. 4 hours)

6. 基于生物学启发的机器人：结构设计（第 11、12 周，4 节课）
6. Robots Based on Biological Enlightenment : structure design (week 11, 12. 4 hours)

7. 基于生物学启发的机器人：运动控制（第 13、14 周，4 节课）
7. Robots Based on Biological Enlightenment : movement control (week 13, 14. 4 hours)

8. 基于生物学启发的机器人：样机测试（第 15、16 周，4 节课）
8. Robots Based on Biological Enlightenment : prototype testing (week 15, 16. 4 hours)

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

1. 机器人手册（第3卷），布鲁诺.西西利亚诺， 欧沙玛.哈提卜，机械工业出版社， 2017年01月
Handbook of Robotics (Vol. 3), Bruno Siciliano, OussamaKhatib, Springer press, Jan. 2017
2. 机器人手册（第1卷），布鲁诺.西西利亚诺， 欧沙玛.哈提卜，机械工业出版社， 2017年01月
Handbook of Robotics (Vol. 1), Bruno Siciliano, OussamaKhatib, Springer press, Jan. 2017
机器人手册（第2卷），布鲁诺.西西利亚诺， 欧沙玛.哈提卜，机械工业出版社， 2017年01月
Handbook of Robotics (Vol. 2), Bruno Siciliano, OussamaKhatib, Springer press, Jan. 2017

## 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 | | | | |
| 课堂表现 Class Performance | | | | |
| 小测验 | | | | |

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| **Quiz** | | | | |
| **课程项目 Projects** | | 50（项目 1）+50（项目 2） | | |
| **平时作业 Assignments** | | | | |
| **期中考试 Mid-Term Test** | | | | |
| **期末考试 Final Exam** | | | | |
| **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**

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| √ **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**

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| 机械与能源工程系教学委员会 |