

## ME313 《产品设计实践》课程大纲

- 1、2020 秋季学期 (2)
- 2、2021 夏季学期起 (8)

# 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.	<b>课程名称 Course Title</b>	产品设计实践 Product Design Practice
2.	<b>授课院系 Originating Department</b>	机械与能源工程系 Department of Mechanical and Energy Engineering
3.	<b>课程编号 Course Code</b>	ME313
4.	<b>课程学分 Credit Value</b>	3
5.	<b>课程类别 Course Type</b>	专业核心课 Major Core Courses
6.	<b>授课学期 Semester</b>	2020 秋季 2020 Fall
7.	<b>授课语言 Teaching Language</b>	中英双语 English & Chinese
8.	<b>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 &amp; Contact (For team teaching, please list all instructors)</b>	柯文德, 机械与能源工程系, <a href="mailto:kewd@sustech.edu.cn">kewd@sustech.edu.cn</a> Wende Ke, Department of Mechanical and Energy Engineering, <a href="mailto:kewd@sustech.edu.cn">kewd@sustech.edu.cn</a>

9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	待公布 To be announced				
10.	选课人数限额(可不填) <b>Maximum Enrolment (Optional)</b>					
11.	授课方式 <b>Delivery Method</b>	讲授 <b>Lectures</b>	习题/辅导/讨论 <b>Tutorials</b>	实验/实习 <b>Lab/Practical</b>	其它(请具体注明) <b>Other (Please specify)</b>	总学时 <b>Total</b>
	学时数 <b>Credit Hours</b>	32		32		64
12.	先修课程、其它学习要求 <b>Pre-requisites or Other Academic Requirements</b>	ME303 机械设计基础 Fundamentals of Machine Design 或者 ME306 机器人基础 Fundamentals of Robotics 或者 ME331 机器人建模与控制 Robot Modeling and Control				
13.	后续课程、其它学习规划 <b>Courses for which this course is a pre-requisite</b>					
14.	其它要求修读本课程的学系 <b>Cross-listing Dept.</b>					

**教学大纲及教学日历 SYLLABUS**

15. 教学目标 **Course Objectives**

《产品设计实践》系统性讲授机器人创新性思维、具有行业特色的机器人、人-机器人伦理及创新产品设计方法等。通过本课程的讲授及实验项目将使学生培养机器人研制的创新思维及方法，通过设计过程向学生介绍解决机器人工程问题的方法和技术，培养学生创造性思维、建设性的实践以及满足客户化需求的能力，以此提高对行业实际问题的分析能力和解决能力、培养学生国际化思维以及团队协作管理复合能力。

The course will be taught in both English and Chinese. The robot innovation, application of robot, ethic of human-robot and design methods of new products are discussed.

The projects based on experiments help students to master the corresponding knowledge about robotics and automation, utilize a design process to introduce students the methods and techniques for solving mechanical engineering problems, cultivate the students' innovative thinking and practice, and the ability to meet the customizing design. improve their practical ability and train their international thinking method and team cooperation.

**16. 预达学习成果 Learning Outcomes**

《产品设计实践》课程通过系统性讲授机器人产品设计思想、理念、方法等知识，指导学生通过机器人工程项目调研基本工具，学会工程实践项目开发基本流程及方法，并采用课程分组项目实现以学生掌握知识为目标，提高学生实际能力、培养学生国际化思维以及团队协作管理复合能力的目标，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。

In the course of product design practice, students are guided to learn the basic tools of robot engineering project research and learn the basic process and methods of engineering practice project development by systematically teaching robot product design ideas, concepts, methods and other knowledge. We will direct the students to master the basic tools of engineering project investigation, and that can be used for the realization of practical project. Students can learn the basic process and method of engineering project development, and apply it to practice project realization.

**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.)**

章节 Section	内容 Contents
1 (2 课时) 1 (2 credit hours)	创新性思维分析 Analysis of innovative thinking
2 (2 课时) 2 (2 credit hours)	市场调研、设计理念及伦理 Market investigation, design concept and ethic
3 (2 课时) 3 (2 credit hours)	机器人创新技术及开发方法 Innovative technologies and developments in robotics
4 (2 课时) 4 (2 credit hours)	机器人产品设计思维、客户需求、观察研究 Design Thinking, customer needs, observation studies of robot products

5 (2 课时) 5 (2 credit hours)	产品规格和项目讨论 Product specifications, project discussions
6 (2 课时) 6 (2 credit hours)	设计的体现——产品架构, 项目讨论 Embodiment design - Product Architecture, project discussions
7 (2 课时) 7 (2 credit hours)	产品设计过程管理方法 Process management of product design
8 (2 课时) 8 (2 credit hours)	创新设计中的人-机器人物理交互中的安全性 Security in human-robot physical interaction of innovative design
9 (2 课时) 9 (2 credit hours)	项目中期展示及答辩 Mid term exhibition and dissertation of the project
10 (2 课时) 10 (2 credit hours)	经济分析和项目讨论 Economic analysis, project discussions
11 (2 课时) 11 (2 credit hours)	整体设计和文化背景 Global design - cultural aspects
12 (2 课时) 12 (2 credit hours)	案例分析 1: 医疗机器人与计算机集成手术的产品创新与市场化进程 Case analysis 1: product innovation and market process of medical robot and computer integrated surgery
13 (2 课时) 13 (2 credit hours)	案例分析 2: 类人机器人产品创新及市场化进程 Case analysis 2: product innovation and market process of humanoid robot
14 (2 课时) 14 (2 credit hours)	案例分析 3: 建筑机器人产品创新设计及市场化进程 Case analysis 3: product innovation design and market process of construction robot
15 (2 课时) 15 (2 credit hours)	案例分析 4: 智能车辆产品创新设计及市场化进程 Case analysis 4: product innovation design and market process of intelligent vehicle
16 (2 课时) 16 (2 credit hours)	项目答辩 Dissertation of projects
<b>实验 Experiments</b>	
1. 水下机器人样机设计: 基本原理及讨论 (2 课时) 1. Underwater robot prototype: basic principles and discussion (2 credit hours)	
2. 水下机器人样机设计: 概念设计与创新、经济分析、讨论 (2 课时) 2. Underwater robot prototype: Concept design and innovations, economic analysis and discussion (2 credit hours)	
3. 水下机器人样机设计: 产品架构、问题分析、功能构造、讨论 (2 课时) 3. Underwater robot prototype: product architecture, problem analysis, function construction and discussion (2 credit hours)	

4. 水下机器人样机设计：结构分析、讨论（2 课时） 4. Underwater robot prototype: analysis and discussion (2 credit hours)
5. 水下机器人样机设计：结构设计、修正优化与讨论（4 课时） 5. Underwater robot prototype: design, modification, optimization of structure and discussion (4 credit hours)
6. 水下机器人样机设计：电机控制与讨论（4 课时） 6. Underwater robot prototype: controls of motor and discussion (4 credit hours)
7. 水下机器人样机设计：图传通信控制与讨论（2 课时） 7. Underwater robot prototype: controls graphic & video communication and discussion (2 credit hours)
8. 水下机器人样机设计：数传通信控制与讨论（2 课时） 8. Underwater robot prototype: control of data communication and discussion (2 credit hours)
9. 水下机器人样机设计：总体装配及讨论（4 课时） 9. Underwater robot prototype: general assembly and discussion (4 credit hours)
10. 水下机器人样机设计：样机调试及讨论（2 课时） 10. Underwater robot prototype: prototype testing and discussion (2 credit hours)
11. 水下机器人样机设计：样机测试、反馈修改及讨论（4 课时） 11. Underwater robot prototype: prototype testing, modification and discussion (4 credit hours)
12. 水下机器人样机设计：答辩及讨论（2 课时） 12. Underwater robot prototype: dissertation of project and discussion (2 credit hours)

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

<p>教材 Textbook</p> <p>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</p> <p>其他它参考资料Supplementary Readings</p> <p>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</p> <p>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</p>
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**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 Quiz				
课程项目 Projects		70		(功能完成情况)
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)		30		(答辩)

20. 记分方式 GRADING SYSTEM

<input checked="" type="checkbox"/> A. 十三级等级制 Letter Grading <input type="checkbox"/> B. 二级记分制 (通过/不通过) Pass/Fail Grading
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**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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# 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.	<b>课程名称 Course Title</b>	产品设计实践 Product Design Practice
2.	<b>授课院系 Originating Department</b>	机械与能源工程系 Department of Mechanical and Energy Engineering
3.	<b>课程编号 Course Code</b>	ME313
4.	<b>课程学分 Credit Value</b>	3
5.	<b>课程类别 Course Type</b>	专业核心课 Major Core Courses
6.	<b>授课学期 Semester</b>	夏季 Summer / 秋季 Fall / 春季 Spring (从 2021 夏季学期起)
7.	<b>授课语言 Teaching Language</b>	中英双语 English & Chinese
8.	<b>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 &amp; Contact (For team teaching, please list all instructors)</b>	春季/秋季: 柯文德, 机械与能源工程系, kewd@sustech.edu.cn 夏季: 魏艳, 机械与能源工程系, weiy@sustech.edu.cn Fall and Spring: Wende Ke, Department of Mechanical and Energy Engineering, kewd@sustech.edu.cn Summer: Yan Wei, Department of Mechanical and Energy Engineering,



	weiy@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		64
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	ME303 机械设计基础 Fundamentals of Machine Design 或者 ME306 机器人基础 Fundamentals of Robotics 或者 ME331 机器人建模与控制 Robot Modeling and Control				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite					
14. 其它要求修读本课程的学系 Cross-listing Dept.					

### 教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

《产品设计实践》系统性讲授优秀产品设计案例、产品概念及特征分析、质量控制方法，以及全球知名企业的产品设计管理经验等。通过本课程的讲授及实验项目将使学生培养产品研制的创新思维及方法，通过设计过程向学生介绍解决产品设计问题的方法和技术，培养学生创造性思维、建设性的实践以及满足客户化需求的能力，以此提高对行业实际问题的分析能力和解决能力、培养学生国际化思维以及团队协作管理复合能力。

The course will be taught in both English and Chinese. Product Design Practice systematically teaches excellent product design cases, product concept and feature analysis, quality control methods, and product design management experience of global famous enterprises. Through the teaching and experimental projects of course, students will be cultivated in innovative thinking, method and understanding customer needs in product development, and be capable to solve product design problems through the design process. The learning process will also help students to improve the ability to analyze and solve practical problems in the industry, cultivate their international thinking and team cooperation management.

#### 16. 预达学习成果 Learning Outcomes

《产品设计实践》课程通过系统性讲授产品设计思想、理念、方法等知识，指导学生学产品工程项目调研基本工具，学会工程实践项目开发基本流程及方法，并采用课程分组项目实现以学生掌握知识为目标，提高学生实际能力、培养学生国际化思维以及团队协作管理复合能力的目标，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。

In the course of product design practice, students are guided to learn the basic tools of product engineering project research and learn the basic process and methods of engineering practice project development by systematically teaching product design ideas, concepts, methods and other knowledge. We will direct the students to master the basic tools of engineering project investigation, and that can be used for the realization of practical project. Students can learn the basic process and method of engineering project development, and apply it to practice project realization.

#### 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.)**

章节 Section	内容 Contents
1 (2 课时) 1 (2 credit hours)	产品设计与开发介绍 Introduction to product design and development
2 (2 课时) 2 (2 credit hours)	开发过程与组织、产品标识 Development processes and organizations, opportunity identification

3 (2 课时) 3 (2 credit hours)	产品计划、确定用户需求 Product planning, identifying customer needs
4 (2 课时) 4 (2 credit hours)	产品规格、概念生成 Product specifications, concept generation
5 (2 课时) 5 (2 credit hours)	概念选择 Concept selection
6 (2 课时) 6 (2 credit hours)	概念测试、产品架构 Concept testing, product architecture
7 (2 课时) 7 (2 credit hours)	工业设计 Industrial design
8 (2 课时) 8 (2 credit hours)	Design for environment 为环境而设计
9 (2 课时) 9 (2 credit hours)	Design for manufacturing 为制造而设计
10 (2 课时) 10 (2 credit hours)	产品原型 Prototyping
11 (2 课时) 11 (2 credit hours)	健壮性设计 Robust design
12 (2 课时) 12 (2 credit hours)	专利与知识产权 Patents and intellectual property
13 (2 课时) 13 (2 credit hours)	服务设计 Design of services
14 (2 课时) 14 (2 credit hours)	产品开发经济学 Product development economics
15 (2 课时) 15 (2 credit hours)	管理项目 Managing projects
16 (2 课时) 16 (2 credit hours)	项目答辩 Dissertation of projects
<b>实验 Experiments</b>	
1. 创新性产品设计案例及讨论 1 - 生活用品 (2 课时) 1. Cases and discussion of innovative product design 1 - articles for daily use ( 2 credit hours)	
2. 产品模仿设计实验 (2 课时) 2. Product Imitation Design Experiment ( 2 credit hours)	

3. 创新性产品设计案例及讨论 2 - 生活用品 (2 课时) 3. Cases and discussion of innovative product design 2 ( 2 credit hours)
4. 产品模仿设计实验 (2 课时) 4. Product Imitation Design Experiment ( 2 credit hours)
5. 创新性产品设计案例及讨论 3 - 工业产品 (2 课时) 5. Cases and discussion of innovative product design 3 - industrial products ( 2 credit hours)
6. 产品模仿设计实验 (2 课时) 6. Product Imitation Design Experiment ( 2 credit hours)
7. 创新性产品设计案例及讨论 4 - 工业产品 (2 课时) 7. Cases and discussion of innovative product design 4 - industrial products ( 2 credit hours)
8. 产品模仿设计实验 (2 课时) 8. Product Imitation Design Experiment ( 2 credit hours)
9. 项目产品概念设计 (2 课时) 9. Product concept design of project (2 credit hours)
10. 项目产品建模设计 (2 课时) 10. Product model of project (2 credit hours)
11. 项目产品建模设计 (2 课时) 11. Product model of project (2 credit hours)
12. 项目产品装配 (2 课时) 12. Product assembling of project (2 credit hours)
13. 项目产品测试 (2 课时) 13. Product test model of project (2 credit hours)
14. 项目产品测试 (2 课时) 14. Product test model of project (2 credit hours)
15. 项目产品测试 (2 课时) 15. Product test model of project (2 credit hours)
16. 项目答辩 (2 课时) 16. Dissertation of projects (2 credit hours)

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

教材 Textbook Product design and development(Sixth Edition). By Karl T. Ulrich, Steven D. Eppinger. Mc Graw Hill Education. 2016
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### 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		(学生出勤情况)
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects		60		(功能完成情况)
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)		30		(实验)

### 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

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