

## 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 <b>Course Title</b>	先进制造系统 <b>Advanced Manufacturing Systems</b>				
2.	授课院系 <b>Originating Department</b>	机械与能源工程系 Department of Mechanical and Energy Engineering				
3.	课程编号 <b>Course Code</b>	ME451				
4.	课程学分 <b>Credit Value</b>	3				
5.	课程类别 <b>Course Type</b>	专业核心课 Major Core Courses				
6.	授课学期 <b>Semester</b>	春季 Spring				
7.	授课语言 <b>Teaching Language</b>	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） <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	赵永华，机械与能源工程系，Email: zhaoyh@sustech.edu.cn Yonghua Zhao, Department of Mechanical and Energy Engineering, Email: zhaoyh@sustech.edu.cn				
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	助教 Please list all Tutor/TA(s)				
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>	48			0	48

12. 先修课程、其它学习要求 <b>Pre-requisites or Other Academic Requirements</b>	
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**

本课程的主要目标是让学生对使用最新技术和方法生产机械部件的先进制造系统有一个基本的理解，并且使学生能够使用现代先进的工艺和技术对机械组件制造系统进行分析。

The primary goal of this course is to impart to the student an understanding of advanced systems for the production of mechanical components using the latest technologies and methods and to enable the student to analyze systems for the production of mechanical components using modern advanced processes and technologies.

16. **预达学习成果 Learning Outcomes**

本课程强调设计过程和制造系统的计算机自动化，并介绍了现代设计和制造设施中使用的自动化技术。课程内容涉及计算机辅助设计（CAD），计算机辅助工程（CAE），计算机辅助制造（CAM），机器人，材料资源规划，工具管理，信息管理，过程控制，质量控制的系统集成等。学期结束后学生将了解当前制造制造系统的能力，应用，限制，趋势和经济考虑因素等。

This course emphasizes the computer automation of design and manufacturing systems. A survey of the automation techniques used in modern design and manufacturing facilities is presented. Discussions are presented related to the system integration of computer-aided design (CAD), computer-aided engineering (CAE), computer-aided manufacturing (CAM), robotics, material resource planning, tool management, information management, process control, quality control, etc. Students will gain an understanding of current capabilities, applications, limitations, trends, and economic consideration.

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.)**



课程内容	教学要求	课时
1) 绪论 <ul style="list-style-type: none"> <li>● 制造系统的定义, 发展历史</li> <li>● 制造系统的构成</li> <li>● 制造系统的分类及特点</li> </ul> Introduction of manufacturing system (MS) <ul style="list-style-type: none"> <li>● Definition and development history of MS</li> <li>● Constitution of manufacturing system</li> <li>● Classification and characteristics of MS</li> </ul>	了解制造系统的构成及特点, 了解制造系统中的核心技术及其信息化  Understand the composition and characteristics of manufacturing systems, understand the core technologies in manufacturing systems and their informatization	2
2) 智能制造与工业 4.0 概述 <ul style="list-style-type: none"> <li>● 制造技术的信息化</li> <li>● 制造系统建模与数字化工厂</li> <li>● 工业 4.0 及未来制造</li> </ul> Intelligent manufacturing and Industry 4.0 <ul style="list-style-type: none"> <li>● Informatization of manufacturing technology</li> <li>● Modeling and digital factory</li> <li>● Industry 4.0 &amp; Future Manufacturing</li> </ul>	了解制造系统的建模技术及数字化工厂的概念, 了解工业 4.0 的基本特征, 了解未来制造系统的发展趋势  Understand the modeling techniques of manufacturing systems and the concept of digital factories, understand the basic characteristics of Industry 4.0, and understand the trends of future manufacturing systems	2
3) 产品设计与制造的计算机化 <ul style="list-style-type: none"> <li>● 产品设计与计算机辅助设计</li> <li>● 计算机辅助制造</li> <li>● 计算机集成制造</li> </ul> Product design and CAD/CAM in MS <ul style="list-style-type: none"> <li>● Product design and CAD</li> <li>● Computer aided manufacturing (CAM)</li> <li>● Computer integrated manufacturing (CIM)</li> </ul>	了解产品设计过程及计算机辅助设计方法, 了解计算机辅助制造方法  Understand the product design process and computer-aided design methods, and understand computer-aided manufacturing methods	2
4) 先进设计技术 <ul style="list-style-type: none"> <li>● 面向 X 的设计</li> <li>● 模块化设计</li> <li>● 产品数据管理</li> </ul> Advanced design technology <ul style="list-style-type: none"> <li>● Design for X</li> <li>● Modular design</li> <li>● Product data management</li> </ul>	了解先进的产品设计技术  Learn about advanced product design techniques	2
5) 计算机辅助工艺规划 <ul style="list-style-type: none"> <li>● 加工方法与工艺规划</li> <li>● 并行工程与先进设计</li> </ul> Computer-aided Process Planning (CAPP) <ul style="list-style-type: none"> <li>● Manufacturing process &amp; Process planning</li> <li>● Concurrent engineering &amp; Design for manufacturing</li> </ul>	了解基本加工方法及计算机辅助工艺规划方法, 了解并行工程  Understand basic processing methods and computer-aided process planning methods, and understand concurrent engineering	2
6) 计算机数字控制技术 <ul style="list-style-type: none"> <li>● 数控技术基础</li> <li>● 数控技术应用</li> <li>● 数控技术中的插补与定位</li> <li>● 数控编程方法</li> </ul> Computer numerical control <ul style="list-style-type: none"> <li>● Fundamentals of NC technology</li> <li>● Applications of NC</li> <li>● Analysis of interpolation &amp; positioning system</li> <li>● NC part programming</li> </ul>	了解数控系统的基本组成单元, 插补方法, 掌握数控编程常用指令  Understand the basic components of the CNC system, the interpolation method, master the common instructions of CNC programming	2
7) 工业机器人技术 <ul style="list-style-type: none"> <li>● 机器人基础</li> <li>● 机器人控制系统</li> <li>● 机器人编程</li> </ul> Industrial robotics <ul style="list-style-type: none"> <li>● Robot anatomy and related attributes</li> <li>● Robot control system</li> <li>● Robot programming</li> </ul>	了解工业机器人的基础及其应用, 了解机器人的控制系统及编程技术  Understand the basics and applications of industrial robots, understand robot control systems and programming techniques	2
8) 自动化与过程控制的核心硬件 <ul style="list-style-type: none"> <li>● 传感器&amp;驱动器</li> <li>● 模数转换器&amp;逻辑控制器</li> </ul>	掌握自动化技术的核心硬件及其原理  Master the core hardware of automation technology and its principle	2



<ul style="list-style-type: none"> <li>● 输入输出装置</li> </ul> <p>Hardware components for automation and process control</p> <ul style="list-style-type: none"> <li>● Sensors &amp; Actuators</li> <li>● Analog-digital conversions &amp; PLC</li> <li>● Input/Output devices for discrete data</li> </ul>		
<p>9) 离散控制与可编程逻辑控制器</p> <ul style="list-style-type: none"> <li>● 离散过程控制</li> <li>● 可编程逻辑控制器</li> </ul> <p>Discrete control and programmable logic controllers</p> <ul style="list-style-type: none"> <li>● Sensors &amp; Actuators</li> <li>● Analog-digital conversions &amp; PLC</li> </ul> <p>Input/Output devices for discrete data</p>	<p>了解离散过程控制与可编程逻辑控制器原理</p> <p>Understand the principles of discrete process control and programmable logic controllers</p>	2
<p>10) 物料搬运与识别</p> <ul style="list-style-type: none"> <li>● 物料搬运设备与系统</li> <li>● 自动物料存储方法与系统</li> <li>● 自动识别与信息获取</li> </ul> <p>Material handling and identification</p> <ul style="list-style-type: none"> <li>● Material transport equipment and system</li> <li>● Automated storage systems</li> <li>● Automatic identification and data capture</li> </ul>	<p>了解常用的物料搬运及自动存储系统，了解物料自动识别与信息获取技术</p> <p>Understand common material handling and automatic storage systems, learn about automatic material identification and information acquisition technology.</p>	2
<p>11) 制造系统部分课程回顾及口头报告</p> <p>Review of the previous contents &amp; Presentations</p>	<p>掌握制造系统的基础概念，思考未来制造系统的发展趋势</p> <p>Master the basic concepts of manufacturing systems and think about the future development trend of manufacturing systems</p>	2
<p>12) 先进制造模式</p> <ul style="list-style-type: none"> <li>● 制造模式的类型</li> <li>● 敏捷制造</li> <li>● 成组技术</li> </ul> <p>Advanced manufacturing modes</p> <ul style="list-style-type: none"> <li>● Types of manufacturing modes</li> <li>● Agile Manufacturing (AM)</li> <li>● Group Technology (GT)</li> </ul>	<p>了解常见的先进制造模式及其作用</p> <p>Understand common advanced manufacturing models and their role</p>	2
<p>13) 先进制造模式</p> <ul style="list-style-type: none"> <li>● 精益生产</li> <li>● 虚拟制造</li> <li>● 智能制造</li> <li>● 集中制造模式的比较</li> </ul> <p>Advanced manufacturing modes</p> <ul style="list-style-type: none"> <li>● Lean production (LP)</li> <li>● Virtual manufacturing (AM)</li> <li>● Intelligent manufacturing (IM)</li> <li>● Comparison between different modes</li> </ul>	<p>了解常见的先进制造模式及其作用</p> <p>Understand common advanced manufacturing models and their role</p>	2
<p>14) 先进制造装备</p> <ul style="list-style-type: none"> <li>● 制造自动化简述</li> <li>● 加工中心</li> <li>● 柔性制造系统</li> </ul> <p>Advanced manufacturing equipment</p> <ul style="list-style-type: none"> <li>● Introduction of manufacturing automation</li> <li>● Machining center</li> <li>● Flexible manufacturing system</li> </ul>	<p>了解先进制造装备</p> <p>Learn about advanced manufacturing equipment</p>	2
<p>15) 先进制造技术</p> <ul style="list-style-type: none"> <li>● 快速成型制造</li> <li>● 高能束加工技术</li> <li>● 超精密加工技术</li> </ul> <p>Advanced manufacturing technology</p> <ul style="list-style-type: none"> <li>● Rapid prototyping manufacturing (RPM)</li> <li>● High energy beam machining technology</li> <li>● Ultra-precision machining technology</li> </ul>	<p>了解先进制造技术</p> <p>Learn about advanced manufacturing technology</p>	2

<p>16) 先进制造工艺技术</p> <ul style="list-style-type: none"> <li>● 微纳制造</li> <li>● 生物制造</li> </ul> <p>Advanced manufacturing technology</p> <ul style="list-style-type: none"> <li>● Micro/Nano manufacturing</li> <li>● Biological manufacturing</li> </ul>	<p>了解先进制造技术 Learn about advanced manufacturing technology</p>	2
<p>17) 质量控制系统</p> <ul style="list-style-type: none"> <li>● 质量控制基础</li> <li>● 统计过程控制</li> </ul> <p>Quality control systems</p> <ul style="list-style-type: none"> <li>● Fundamentals of quality control</li> <li>● Statistical process control</li> </ul>	<p>了解质量控制的基本概念及方法 Understand the basic concepts and methods of quality control</p>	2
<p>18) 质量控制系统</p> <p>六西格玛</p> <p>质量工程中的田口方法</p> <p>Quality control systems</p> <ul style="list-style-type: none"> <li>● Six sigma</li> <li>● Taguchi methods in quality engineering</li> </ul>	<p>了解质量控制的基本概念及方法 Understand the basic concepts and methods of quality control</p>	2
<p>19) 检测原理与技术</p> <ul style="list-style-type: none"> <li>● 取样与检测</li> <li>● 检测自动化</li> <li>● 测量与定量技术及设备</li> </ul> <p>Inspection principles and technologies</p> <ul style="list-style-type: none"> <li>● Sampling versus 100% inspection</li> <li>● Automated inspection</li> <li>● Measuring machines and methods</li> </ul>	<p>了解检测基本原理与技术 Understand the basic principles and techniques of detection</p>	2
<p>20) 课程回顾及口头报告</p> <p>Review of the previous contents &amp; Presentations</p>		2
<p>21) 典型产品的制造系统</p> <ul style="list-style-type: none"> <li>● 汽车制造系统</li> <li>● 集成电路制造系统</li> <li>● 计算机制造系统</li> </ul> <p>Manufacturing system of typical products</p> <ul style="list-style-type: none"> <li>● Cars</li> <li>● Integrated circuits</li> <li>● Computers</li> </ul>	<p>了解典型产品的生产系统 Understand the production system of a typical product</p>	2
<p>22) 绿色设计与制造</p> <ul style="list-style-type: none"> <li>● 绿色产品</li> <li>● 生态化设计</li> <li>● 清洁化生产</li> </ul> <p>Green products</p> <ul style="list-style-type: none"> <li>● Ecological design</li> <li>● Clean production</li> </ul>	<p>理解绿色制造的内涵 Understand the connotation of green manufacturing</p>	2
<p>23) 未来智能制造系统</p> <ul style="list-style-type: none"> <li>● 物联网</li> <li>● 大数据</li> <li>● 人工智能</li> </ul> <p>Future intelligent manufacturing system</p> <ul style="list-style-type: none"> <li>● Internet of Things</li> <li>● Big data</li> <li>● Artificial intelligence</li> </ul>	<p>思考未来智能制造系统的模式及核心技术 Thinking about the model and core technology of the future intelligent manufacturing system</p>	2
<p>24) 制造系统与社会 MS and Society (6 credit hours)</p> <ul style="list-style-type: none"> <li>● 社会对制造系统的要求与期待制造与环境问题</li> <li>● 循环性生产&amp;环境管理</li> <li>● 逆向制造</li> <li>● 制造业的将来</li> </ul> <ul style="list-style-type: none"> <li>● Requirements and expectation of society to MS</li> <li>● Environment problems in manufacturing</li> <li>● Circular production &amp; Environmental management</li> <li>● Inverse manufacturing</li> <li>● Future of MS</li> </ul>	<p>思考未来制造系统的特点及发展趋势 Thinking about the characteristics and development trends of future manufacturing systems</p>	2

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

1) Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 5th Edition, John Wiley & Sons Inc. ISBN: 9781118231463

**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		10		
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		35		
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		50		
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**