

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	机械制造基础 Fundamentals of Manufacturing
2.	授课院系 Originating Department	机械与能源工程系 Department of Mechanical and Energy Engineering
3.	课程编号 Course Code	ME302
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业核心课 Major Core Course
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)	吴勇波 机械与能源工程系, 慧园 5-411, 88018156, 13710242998 Yongbo Wu, Department of Mechanical and Energy Engineering, Wisdom Valley 5-411, phone: 88018156, mobile: 13710242998 邓辉/助理教授 机械与能源工程系 Hui DENG / Assistant professor Department of Mechanical and Energy Engineering Email: dengh@sustc.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	48				48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	ME103 制造工程认知实践 Awareness Practice of Manufacturing Engineering ME303 机械设计基础 Fundamentals of Machine Design				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	ME308 先进制造实践 Advanced Manufacturing Practice ME407 精密加工技术 Precision Machining Technology				
14. 其它要求修读本课程的学系 Cross-listing Dept.	材料科学与工程, Materials Science and Engineering, 力学与航空航天 Mechanics and Aerospace Engineering				

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

中国制造 2025 作为国家战略已经开始实施。机械制造是实现中国制造的核心。本课程面向具有“12.先修课程”所列的一定先期学习基础的本科（3-4 年级）或研究生教授机械制造基础。重点涉及到材料的加工工艺与设备和制造系统的基本原理以及近期发展等。通过课程学习，学生可以掌握基本的材料加工知识，为进一步在制造领域学习和工作打好基础。

China Manufacturing 2025 program has launched as a national development strategy. Mechanical manufacturing is the key to implement this program. This course will teach fundamentals of manufacturing to the undergraduate students who are in year 3 or 4 or graduate students. The students should have passed basic knowledge of manufacturing of materials as mentioned in section 12. The students are expected after the course learning to know well the basis of processing principle of materials, the equipment and manufacturing systems, as well the latest development of manufacturing.

16. 预达学习成果 Learning Outcomes

通过课程学习，学生基本了解和掌握材料的基本加工方法，包括原理、工艺过程和设备、制造系统构成与自动化、以及相关科学技术最新进展。学生将来无论是进一步深造和进行科研工作或者是到制造企业工作，都具备坚实的材料机械制造基础。

未来的学习和工作领域可以包括：机械工程、制造工程、材料科学与工程等。

Through this course learning, the students shall know well the basis of materials processing technologies including principles, processes and equipments, Manufacturing systems and automation, as well as the latest development of related technologies. The knowledge learnt through this course will be useful for their further study or works. Their future interested subjects include processing and manufacturing of materials, mechanical engineering, materials science and engineering, and related areas.

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	学时分配
<p>1.机械制造基础总论</p> <ul style="list-style-type: none"> ● 机械制造的应用背景 ● 本课程的性质、任务和主要内容 ● 机械加工的基本概念与方法 <p>General introduction</p> <ul style="list-style-type: none"> ● Application background of mechanical manufacturing ● The objectives and outcome of mechanical manufacturing ● Concept and methods of mechanical manufacturing 	<p>了解机械制造的背景，不同加工方法的概念及其特点</p> <p>Understand the history and importance of mechanical manufacturing</p> <p>Understand the different process technology.</p>	2
<p>2.铸造工艺引论</p> <ul style="list-style-type: none"> ● 铸造的历史，方法及其应用 <p>Fundamentals of Metal Casting</p> <ul style="list-style-type: none"> ● The history, method and application of casting 	<p>了解铸造工艺的国家标准，了解常用的设备和方法</p> <p>Understand National standards for metal casting and its mainly equipment & technology</p>	1
<p>2.1.铸造工艺与设备</p> <ul style="list-style-type: none"> ● 铸造工艺的基本原理 ● 铸造工艺的过程 ● 铸造工艺的设计、材料及其经济性 <p>Fundamentals of Metal Casting</p> <ul style="list-style-type: none"> ● Fundamentals for metal casting ● Metal-casting processes ● Metal-casting: design, materials, economics 	<p>掌握铸造工艺的基本原理，设计以及实用经济性</p> <p>Learn the basic principles of casting technology, design and practical economy</p>	3
<p>2.2.成形加工工艺与设备 1</p> <ul style="list-style-type: none"> ● 金属轧制 ● 金属锻造 ● 金属的挤压和拉拔 <p>Forming and Shaping Processes and Equipment 1</p> <ul style="list-style-type: none"> ● Rolling of metal ● Forging of metal ● Extrusion and drawing of metals 	<p>掌握金属成形过程中的轧制、锻造及其挤压和拉拔</p> <p>Understand the forming and shaping processes</p>	3
<p>2.3.成形加工工艺与设备 2</p> <ul style="list-style-type: none"> ● 板材金属成形工艺 ● 快速成形操作 <p>Forming and Shaping Processes and Equipment 2</p> <ul style="list-style-type: none"> ● Sheet-metal forming processes ● Rapid-prototyping operations 	<p>掌握板材金属加工成形工艺，快速成形操作技术</p> <p>Understand Sheet-metal forming processes and Rapid-prototyping operations</p>	3
<p>2.4.成形加工工艺与设备 3</p> <ul style="list-style-type: none"> ● 刀具材料的切削和切削液 ● 用于生产圆形的加工工艺：车削和制孔 ● 用于生产各种形状的加工工艺：铣削 <p>Forming and Shaping Processes and Equipment 3</p> <ul style="list-style-type: none"> ● Cutting-tool materials and cutting fluids ● Machining processes used to produce round shapes: turning and hole making ● Machining processes used to produce various shapes: milling 	<p>掌握成形加工的材料及工艺</p> <p>Understand machining processes and machine tools</p>	3

<p>2.5. 成形加工工艺与设备 4</p> <ul style="list-style-type: none"> ● 先进的加工概念和结构，以及加工经济性 ● 磨料加工和精加工操作 ● 先进的加工工艺 <p>Forming and Shaping Processes and Equipment 4</p> <ul style="list-style-type: none"> ● Machining centers, advanced machining concepts and structures, and machining economics ● Abrasive machining and finishing operations ● Advanced machining processes 	<p>学习先进的加工成形工艺与设备</p> <p>Advanced machining processes and machine tools</p>	<p>3</p>
<p>3 连接工艺与设备</p> <ul style="list-style-type: none"> ● 熔焊工艺 ● 固态焊接工艺 ● 钎焊，粘接和机械加固工艺 <p>Joining Processes and Equipment</p> <ul style="list-style-type: none"> ● Fusion-welding processes ● Solid-state welding processes ● Brazing soldering, adhesive-bonding, and mechanical-fastening processes 	<p>掌握机械制造过程中的连接工艺与设备</p> <p>Understand joining processes and equipment during machining</p>	<p>4</p>
<p>4. 机械加工基础</p> <ul style="list-style-type: none"> ● 切割力学 ● 刀具寿命：磨损和失效 ● 表面光洁度和完整性 ● 切削加工 <p>Fundamentals of Machining</p> <ul style="list-style-type: none"> ● Mechanics of cutting ● Tool life: wear and failure ● Surface finish and integrity ● Machinability 	<p>掌握机械加工理论概念，原理，设计，应用</p> <p>Master the concept, principle, design and application of machining theory</p>	<p>2</p>
<p>期中考试</p> <p>Midterm Exam</p>	<p>中期考核，检查学生上一阶段学习情况</p> <p>Midterm assessment, check students' learning in the previous stage</p>	<p>3</p>
<p>5. 刀具材料和切削液</p> <ul style="list-style-type: none"> ● 高速钢 ● 碳化物 ● 涂层工具 ● 氧化铝基陶瓷 ● 切削液 <p>Cutting-tool Materials and Cutting Fluids</p> <ul style="list-style-type: none"> ● High-speed steel ● Carbides ● Coated tools ● Alumina-based ceramics ● Cutting fluids 	<p>掌握各种刀具材料及其切削液的应用</p> <p>Understand different cutting-tool materials and Cutting Fluids, their application industry</p>	<p>2</p>
<p>6. 切削加工：车削</p> <ul style="list-style-type: none"> ● 简介 ● 车削过程 ● 车床和车床操作 <p>Machining Processes: Turning</p> <ul style="list-style-type: none"> ● Introduction 	<p>了解车削基本过程和车削车床操作</p> <p>Learn the process of turning and lathe operations</p>	<p>1</p>

<ul style="list-style-type: none"> ● The turning process ● Lathes and lathe operations 		
<p>6.1 切削加工：制孔、铣削、拉削、切断</p> <ul style="list-style-type: none"> ● 制孔与制孔机 ● 铣削和铣床 ● 拉削和拉床 ● 切断 <p>Machining Processes: Hole-making, Milling, Broaching, and Sawing</p> <ul style="list-style-type: none"> ● Hole making and hole-making machines ● Milling and milling machines ● Broaching and Broaching machines ● Sawing 	<p>掌握各种切削加工工艺及相应的设备，清楚各种工艺的应用场景</p> <p>Understand various the machining process and corresponding equipment, and clearly understand the application scenarios of various processes</p>	3
<p>7 金属切削机床</p> <ul style="list-style-type: none"> ● 简介 ● 金属切削过程和切削机床 <p>Machine-tool</p> <ul style="list-style-type: none"> ● Introduction ● Machining process and machine tools 	<p>了解金属切削过程与切削机床</p> <p>Learn metal cutting processes and cutting machine tools</p>	2
<p>8.磨粒加工工艺与设备</p> <ul style="list-style-type: none"> ● 研磨过程 ● 磨削操作与设备 ● 磨削加工的设计影响因素 <p>Abrasive Machining and Finishing Operations</p> <ul style="list-style-type: none"> ● The grinding process ● Grinding operation and machines ● Design considerations for grinding 	<p>学习磨粒加工的过程，原理，操作与设备</p> <p>Learn the process, principle, operation and equipment of abrasive processing</p> <p>掌握磨削加工设计过程的影响因素</p> <p>Understand the influencing factors of the grinding process design process</p>	2
<p>9.特种与微纳加工基础</p> <ul style="list-style-type: none"> ● 化学加工 ● 电化学加工和磨削 ● 激光束加工和电子束加工 <p>Advanced Machining and Micromanufacturing</p> <ul style="list-style-type: none"> ● Chemical machining ● Electrochemical machining and grinding ● Laser-beam machining and electron-beam machining 	<p>掌握机械制造过程中的特种加工，如化学加工，电化学加工，激光加工等等</p> <p>Understand the special processing in the mechanical manufacturing process, such as chemical processing, electrochemical processing, laser processing, etc.</p> <p>掌握微纳加工的原理设计与应用</p> <p>Understand the principle design and application of micro-nano processing</p>	2
<p>10.几何测量与品质评价</p> <ul style="list-style-type: none"> ● 测量标准 ● 传统与现代的测量方法和仪器 ● 质量保证及评价方法 ● 质量控制的统计方法 <p>Engineering Metrology, Instrumentation, and Quality Assurance</p>	<p>掌握机械制造的几何测量和质量保证的控制方法，以及质量评价方法和统计方法</p> <p>Master the control methods of geometric measurement and quality assurance of mechanical manufacturing, as well as quality evaluation methods and</p>	3

<ul style="list-style-type: none"> ● Measurement standards ● Traditional and modern measuring methods and instruments ● Quality Assurance ● Statistical methods of quality control 	statistical methods.	
<p>11.机械制造自动化</p> <ul style="list-style-type: none"> ● 数字控制 ● 工业机器人 ● 装配系统 ● 实用经济性 <p>Automation of Manufacturing Processes and Operations</p> <ul style="list-style-type: none"> ● Numerical control ● Industrial robots ● Assembly system ● Economic considerations 	<p>熟悉机械制造自动化的应用领域及其实用性</p> <p>Familiar with the application field of mechanical manufacturing automation and its practicability</p>	3
<p>12.计算机辅助制造 CAM 与计算机集成制造 CIM</p> <ul style="list-style-type: none"> ● 简介 ● 计算机辅助制造 (CAM) ● 计算机集成制造 (CIM) <p>Computer-aided Manufacturing (CAM) and Computer-integrated Manufacturing (CIM)</p> <ul style="list-style-type: none"> ● Introduction ● Computer-aided Manufacturing (CAM) ● Computer-integrated Manufacturing (CIM) 	<p>学习了解机械加工与计算机结合的前沿发展与技术</p> <p>Learn the cutting-edge development and technology of machining and computer integration</p>	3
Sum		48

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

<p>教科书:</p> <p>Manufacturing Engineering and Technologies, Sixth Edition, Ed Serope Kalpakjian and Steven R. Schmid, Pub Pearson Education.</p> <p>参考书:</p> <ol style="list-style-type: none"> 1.王昆林. 材料工程基础[M].2 版.北京: 清华大学出版社, 2009. 2.毛为民. 工程材料学原理[M].北京: 高等教育出版社, 2009. 3.黄天佑. 材料加工工艺[M].2 版.北京: 清华大学出版社, 2010. 4.卢秉恒. 机械制造技术基础[M].3 版.北京: 机械工业出版社, 2008. 5.王先逵. 机械制造工艺学[M].3 版.北京: 机械工业出版社, 2013. 6.袁哲俊,王先逵. 精密和超精密加工技术[M].3 版.北京: 机械工业出版社, 2016. 7.白基成,刘晋春. 特种加工[M].6 版.北京: 机械工业出版社, 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		5		

小测验 Quiz			
课程项目 Projects	20		
平时作业 Assignments	20		
期中考试 Mid-Term Test			
期末考试 Final Exam	50		
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

