

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	机械设计基础 Introduction to Mechanical Design
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	ME303
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业核心课 Major Core Courses
6.	授课学期 Semester	春季 Spring/秋季 Fall
7.	授课语言 Teaching Language	英文 English
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)	春季 (Spring): 王宏强 Wang Hongqiang 机械与能源工程系 Department of Mechanical and Energy Engineering wanghq6@sustc.edu.cn 秋季 (Fall): 宋超阳, 机械与能源工程系, songcy@sustech.edu.cn Song Chaoyang, Department of Mechanical and Energy Engineering, songcy@sustech.edu.cn 肖啸川 Xiao Xiaochuan 机械与能源工程系 Department of Mechanical and Energy Engineering xiaoxc@sustc.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	助教 毛建军 RA Mao Jianjun 创新创业学院 11849009@sustech.edu.cn
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11. 授课方式 Delivery Method	讲授	习题/辅导/讨论	实验/实习	其它(请具体注明)	总学时
	Lectures	Tutorials	Lab/Practical	Other (Please specify)	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	ME102 CAD 与工程制图 CAD and Engineering Drawing MAE203 理论力学 I Theoretical Mechanics I MSE305 材料力学 Mechanics of Materials				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	ME305 创新设计实践 Innovative Design Practice				
14. 其它要求修读本课程的学系 Cross-listing Dept.	Not Applicable				

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

This course is intended for students beginning the professional study of mechanical engineering. The focus is on combining fundamental concept development with practical specification of mechanical components. Subjects covered by this course include engineering basics, failure prevention, gear components, joint components, flexible components and various other mechanical components. Special topics will be covered regarding the pathway from mechanical engineering fundamentals towards future directions of design engineer in research and industry towards advanced machinery, automation and robotics.

- To teach students how to formulate the design and manufacturing problem for mechanical systems.
- To teach students how to apply the general mechanical engineering sciences in analyses specific to the design of mechanical components.
- To teach students in a laboratory setting how to generate concepts, conduct analyses to size components, construct, assemble, and program a prototype of a system and test its function to meet the specifications of a design and manufacturing problem.
- To reinforce students' team skills through a team project, including problem formulation, problem solutions and written reporting of results.
- To reinforce students' visualization and hands-on skills through project virtual prototyping and/or physical construction exercises.

16. 预达学习成果 Learning Outcomes

As a core course for mechanical engineering major, this course lays the foundation for students to conduct machine design, manufacturing and related research and development. The following learning outcomes are expected for students taking this course:

1. Given functional and manufacturing requirements, utilize concept generation methods within a team setting to achieve a consensus for a product concept.
2. Weigh trade-offs in concept and detail design from the perspectives of function, manufacture, design effort and available resources.
3. Apply basics of conservation and constitutive laws from the mechanical engineering sciences to understand the basic nature of a posed problem.
4. Compile reference (e.g. catalogue, handbook and textbook) resources to formulate an analysis for specific mechanical and mechatronic components addressed within those resources.

5. Make decisions regarding buy or build for individual components of a design.
6. Test, in a team setting or independently, the system performance and all failure modes that may be present per the analyses conducted during the design stage.
7. Communicate engineering decisions, justification for those decisions, designs, manufacturing plans, and test results in multi-media presentation and report writing.

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			
课程内容	教学要求	主讲人	学时分配
Introduction to Mechanical Design <ul style="list-style-type: none"> • Basics about mechanical design • Fundamental notions and approaches to design. 	Understand process of mechanical design. Understand analysis tools.	Wang Hongqiang	2
Materials <ul style="list-style-type: none"> • Material properties • Basic treatment methods • Metals and non-metals 	Learn to material types and mechanical properties Understand basic material treatment method	Wang Hongqiang	2
Kinematics & Load Analysis <ul style="list-style-type: none"> • Mechanism basics • Linkage motions • Equilibrium and free-body diagrams • Load analysis 	Understand kinematics and degree of freedom Learn complex linkage motion analysis method Learn load analysis method of mechanical structure	Wang Hongqiang	4
Failures Resulting from Static Loading <ul style="list-style-type: none"> • Relations between strength and static loading • Failure theories for ductile materials • Failure Theories for Brittle Materials 	Understand the importance of failure analysis. Understand the failure theories for ductile materials. Understand the failure theories for brittle materials. Learn the selection method of failure criteria	Wang Hongqiang	2
Fatigue Failures Resulting from Variable Loading <ul style="list-style-type: none"> • Introduction to fatigue in metals • Fatigue-life methods • Fatigue strength & the endurance limit • Stress concentration and notch sensitivity 	Understand the fatigue failure stages in metals Learn the fatigue life methods Understand Fatigue strength & the endurance limit Understand the Stress Concentration and Notch Sensitivity	Wang Hongqiang	2
Gears in General <ul style="list-style-type: none"> • Key concepts about gears 	Understand about key concepts of gears.	Wang	2

<ul style="list-style-type: none"> • Common Gears • Force Analysis 	<p>Learn the types of common gears. Learn the force analysis of gears.</p>	Hongqiang	
<p>Spur, Helical, Bevel & Worm Gears</p> <ul style="list-style-type: none"> • The basic concepts and analysis theories about spur & helical gears • The basic concepts and analysis theories about bevel & worm gears 	<p>Understand the analysis and design methods for gears spur & helical gears Understand the analysis and design methods for gears bevel & worm gears.</p>	Wang Hongqiang	2
<p>Shafts and Shaft components</p> <ul style="list-style-type: none"> • Shaft Materials • Shaft Layout • Example of Shaft Design • Shaft Components • Limits and Fits 	<p>Understand shaft geometric structures and functions Learn the process to design a shaft</p>	Wang Hongqiang	2
<p>Power Transmission Case Study</p> <ul style="list-style-type: none"> • A power transmission system design 	<p>Learn how to incorporate the details of each component into an overall design process</p>	Wang Hongqiang	2
<p>Non-permanent Joints (Screws, Fasteners)</p> <ul style="list-style-type: none"> • The Mechanics of Power Screws • Joints—Fastener/Member Stiffness • Tension Joints—The External Load 	<p>Understand pre-tightening and anti-loosening of threaded connections Learn the theories about joints—fastener/member stiffness, and tension joints—the external load</p>	Wang Hongqiang	2
<p>Permanent Joints (Welding, Bonding)</p> <ul style="list-style-type: none"> • Butt and Fillet Welds • Stresses in Welded Joints in Torsion Bending • The Strength of Welded Joints 	<p>Understand advantages and applications of welding and bonding. Learn the typical welding and bonding methods. Understanding the stresses in welded joints in torsion or bending, and the strength of welded joints</p>	Wang Hongqiang	2
<p>Bearings, Lubrication, Brakes & Couplings</p> <ul style="list-style-type: none"> • Rolling-contact bearing types • The purposes of an antifriction-bearing lubrication • Static analysis of clutches and brakes 	<p>Know about rolling-contact bearing types. Understand the purposes of an antifriction-bearing lubrication Understand the static analysis, types, and materials of clutches and brakes</p>	Wang Hongqiang	2
<p>Mechanical Springs</p> <ul style="list-style-type: none"> • Types of springs • Design of spring 	<p>Understand types of springs Learn the basic theories of design springs</p>	Wang Hongqiang	2
<p>Flexible Mechanical Components</p> <ul style="list-style-type: none"> • Different types of flexible mechanical components • The characteristics of flexible mechanical structures 	<p>Understand differences between flexible and rigid mechanical components. Learn the characteristics of different types of flexible mechanical components such as belts, flat- and round-belt drives, v belts, timing belts, roller chain, wire rope, flexible shafts.</p>	Wang Hongqiang	2

Mechanical Design for Advanced Robotics <ul style="list-style-type: none"> • Robot Design Process • Mechanical Design Considerations 	Know about advanced robotics. Understand design process of robotics.	Wang Hongqiang	2
Lab			
Training and task <ul style="list-style-type: none"> • Lab machine training 	Learn to operate machines in this lab	Xiao Xiaochuan	2
Four-bar linkages <ul style="list-style-type: none"> • Four-bar linkage • Mechanism principle 	Build linkage and cam structures Understand the DoFs of a mechanical mechanism	Xiao Xiaochuan	6
Project I: design and fabrication <ul style="list-style-type: none"> • Machines operating • Mechanical design based on simple mechanisms and components 	Design and fabricate a prototype using linkages. Learn to write mechanical design report.	Xiao Xiaochuan	2
Project II: Manual Targeting Machine <ul style="list-style-type: none"> • Design of complex mechanisms 	Design and fabricate a machine with higher precision. Enhance leadership and cooperation skills	Xiao Xiaochuan	10
Presentation & Competition <ul style="list-style-type: none"> • Engineering expression skills 	Hone the presentation skills of engineering product. Learn to evaluate and judge different engineering approaches	Xiao Xiaochuan	2
<ul style="list-style-type: none"> • Project III: Shaft design 	Learn to design and evaluate shafts in a gear box	Xiao Xiaochuan	10

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

<ul style="list-style-type: none"> • Textbook: Shigley's Mechanical Engineering Design (McGraw-Hill Series in Mechanical Engineering) 10th Edition by Richard G Budynas (Author), Keith J Nisbett (Author) • Supplementary Readings: Machine Design (5th Edition) 5th Edition by Robert L. Norton (Author)
--

 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		20%		
课堂表现 Class Performance		0		
小测验 Quiz		0		
课程项目 Projects		30%		
平时作业 Assignments		20%		
期中考试 Mid-Term Test		0		
期末考试 Final Exam		30%		

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)**

	0		
	0		

20. 记分方式 **GRADING SYSTEM**

十三级等级制 **Letter 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