

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	机械原理 Principles of Machinery
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	ME213
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业基础课 Major Foundational Courses
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)	潘阳，机械与能源工程系， pany@sustech.edu.cn Department of Mechanical and Energy Engineering Pan Yang, pany@sustech.edu.cn 冯慧娟，机械与能源工程系， fenghj@sustech.edu.cn Department of Mechanical and Energy Engineering Feng Huijuan, fenghj@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)	无 NA

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	48	无 NA	无 NA	无 NA	48
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无 NA				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 NA				
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

通过机械原理课程的课堂教学、机械基础实验和后续的机械原理课程设计等环节，着重培养学生利用机械设计基础理论和机械设计方法来解决复杂机械工程问题的能力，增强创新意识。

Through classroom instruction in the course of Principles of Machinery, basic mechanical experiments, and subsequent mechanical principles course design, the emphasis is placed on cultivating students' ability to solve complex mechanical engineering problems using fundamental theories and methods of mechanical design, and enhancing their innovative thinking.

16. 预达学习成果 Learning Outcomes

通过机械原理课程，学生将达成以下成果：

- 了解机械工程领域的基本问题和发展趋势。
- 掌握机械原理和结构的分析、运动和力学分析。
- 能够设计连杆机构、凸轮机构、齿轮传动和间歇机构。
- 具备计算机辅助分析和设计的能力。
- 能够操作实验设备、分析结果和编写实验报告。
- 具备设计复杂机械系统的能力和有效的表达能力。

Through the Principles of Machinery course, students will achieve the following outcomes:

- Understand the fundamental issues and trends in the field of mechanical engineering.
- Master the analysis of mechanical principles and structures, as well as motion and mechanics analysis.
- Be capable of designing linkages, cam mechanisms, gear transmissions, and intermittent mechanisms.
- Possess the ability for computer-aided analysis and design.
- Have the skill to operate experimental equipment, analyze results, and write experimental reports.
- Demonstrate the capability to design complex mechanical systems and effectively express design ideas.

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 Contents	教学要求 Teaching Requirements	学时分配 Hours
<p>绪论:</p> <ul style="list-style-type: none"> ● 课程性质、内容、学习目的 ● 机械的构成 <p>Introduction:</p> <ul style="list-style-type: none"> ● The nature, content, and learning purpose of the course ● Composition of the machinery 	<p>了解课程的特点，机械工程领域的基本问题，机械的基本构成及发展、演化。</p> <p>Understand the characteristics of the course, the basic problems in the field of mechanical engineering, the basic composition, development and evolution of machinery.</p>	2
<p>机构的结构分析:</p> <ul style="list-style-type: none"> ● 机构的组成及其运动简图的绘制 ● 机构自由度的计算 ● 平面机构的组成原理和结构分析 <p>Structural analysis of the mechanism:</p> <ul style="list-style-type: none"> ● Composition of the mechanism and drawing of kinematic sketch ● Calculation of the degree of freedom of the mechanism ● Composition principles and structural analysis of planar mechanisms 	<p>掌握运动简图的绘制、机构自由度的计算，平面机构的组成原理和结构分析。</p> <p>Master the drawing of kinematic sketch, the calculation of the degrees of freedom of the mechanism, the composition principles and structural analysis of the planar mechanisms.</p>	2
<p>平面机构的运动分析:</p> <ul style="list-style-type: none"> ● 用速度瞬心法对平面机构作速度分析 ● 用杆组法对平面连杆机构进行位移、速度、加速度分析 <p>Motion analysis of planar mechanisms:</p> <ul style="list-style-type: none"> ● Use the instantaneous center of velocities to analyze the velocity of the planar mechanism ● Analyze the displacement, velocity and 	<p>掌握机构运动分析的方法，并能够用计算机对机构进行运动分析。</p> <p>Master the methods of mechanism motion analysis, and be able to use the computer to perform motion analysis on the mechanism.</p>	4

<p>acceleration of the planar linkages using the link-group method.</p>		
<p>平面机构的力分析和机械效率：</p> <ul style="list-style-type: none"> ● 力分析的基本知识，拆杆组法对平面连杆机构进行动态静力分析的数学模型 ● 运动副中的摩擦和考虑摩擦时机构的力分析，机械的效率和自锁 <p>Force analysis and mechanical efficiency of planar mechanisms:</p> <ul style="list-style-type: none"> ● The basic knowledge of force analysis, the mathematical model of static analysis of the planar mechanisms by the dismantling link group method ● Friction in the kinematic pair and force analysis of the mechanism when considering friction, mechanical efficiency and self-locking 	<p>掌握机构力分析的方法，并能够用计算机对机构进行力分析；掌握考虑摩擦时机构的力分析方法，能够计算机械的瞬时效率。</p> <p>Master the methods of mechanism force analysis and be able to use computers to perform force analysis of mechanisms; Master the force analysis method of the mechanism that takes into account the friction and be able to calculate the instantaneous efficiency of machinery</p>	4
<p>平面连杆机构及其设计：</p> <ul style="list-style-type: none"> ● 概述，平面四杆机构的基本类型及其演化 ● 平面四杆机构有曲柄的条件及几个基本概念 ● 平面四杆机构设计 <p>Planar linkages and its design:</p> <ul style="list-style-type: none"> ● An overview of the basic types of planar four-bar mechanisms and their evolution ● The existence conditions of the crank for the planar four-bar mechanism and several basic concepts ● Design of planar four-bar mechanisms 	<p>了解平面四杆机构的演化方式及四杆机构的类型；掌握四杆机构曲柄存在条件的判别及机构压力角、极位夹角的计算；掌握四杆机构的设计方法。</p> <p>Understand the evolution of planar four-bar mechanisms and the types of four-bar mechanisms; Distinguish the existence conditions of the crank of the four-bar mechanism and the calculation of the pressure angle of the mechanism and the crank angle between extreme positions; Master the design method of four-bar mechanism.</p>	4
<p>凸轮机构及其设计：</p> <ul style="list-style-type: none"> ● 凸轮机构的应用及分类，从动件运动规律及其选择 ● 按预定运动规律设计盘形凸轮轮廓，盘形凸轮机构基本尺寸的确定 	<p>了解凸轮机构的类型及应用；了解从动件的各种运动规律及其选用原则；掌握盘形凸轮的设计方法和盘形凸轮基本尺寸的确定；能够应用计算机辅助进行凸轮设计。</p> <p>Understand the types and applications of cam mechanisms; Understand the various motion laws of followers and</p>	4

<ul style="list-style-type: none"> ● 空间凸轮机构简介 <p>Cam mechanism and its design:</p> <ul style="list-style-type: none"> ● The application and classification of cam mechanism, the movement law of followers and its selection ● Design the disc cam profile according to the predetermined motion law, and determine the basic size of the disc cam mechanism ● Introduction to the spatial cam mechanism 	<p>their selection principles; Master the design method of disc cam and the determination of the basic size of disc cam; Able to apply computer-aided cam design.</p>	
<p>齿轮机构及其设计:</p> <ul style="list-style-type: none"> ● 齿轮机构的类型和应用, 瞬时传动比与齿廓曲线, 渐开线和渐开线齿廓啮合传动的特点 ● 渐开线圆柱齿轮及其基本齿廓, 渐开线标准直齿圆柱齿轮的啮合传动 ● 渐开线齿廓的加工原理, 渐开线变位直齿圆柱齿轮啮合传动计算, 斜齿圆柱齿轮传动, 交错轴斜齿轮传动, 蜗杆蜗轮传动, 圆锥齿轮传动。 <p>Gear mechanism and its design:</p> <ul style="list-style-type: none"> ● The type and application of the gear mechanism, the instantaneous transmission ratio and the tooth profile curve, the involute and the involute tooth profile meshing transmission characteristics ● Involute cylindrical gears and their basic tooth profiles, meshing transmission of involute standard spur cylindrical gears ● The processing principle of involute tooth profile, involute displacement spur cylindrical gear meshing transmission calculation, helical cylindrical gear transmission, staggered shaft helical gear transmission, worm and worm gear transmission, bevel gear transmission. 	<p>掌握渐开线的性质, 渐开线齿轮几何尺寸的计算, 标准渐开线齿轮传动计算, 渐开线齿轮的加工原理; 了解渐开线变位齿轮的啮合传动计算, 斜齿轮传动计算, 蜗杆蜗轮传动计算, 圆锥齿轮传动计算。</p> <p>Master the nature of the involute, the calculation of the geometric size of the involute gear, the calculation of the standard involute gear transmission, and the processing principle of the involute gear; Understand the meshing transmission calculation of involute displacement gears, helical gear transmission calculation, worm gear transmission calculation, bevel gear transmission calculation.</p>	8
<p>轮系及其设计:</p> <ul style="list-style-type: none"> ● 轮系的类型, 轮系的传动比计算 ● 行星轮系的效率, 行星轮系的设计, 其它行星传动简介 	<p>了解齿轮传动系统的类型; 掌握齿轮传动系统传动比的计算方法; 掌握行星轮系中各基本构件几何尺寸的设计。</p> <p>Understand the types of gearing systems; Master the calculation method</p>	4

<p>Gear train and its design:</p> <ul style="list-style-type: none"> ● The type of gear train, the calculation of transmission ratio of the gear train ● Planetary gear train efficiency, planetary gear train design, other planetary transmission introduction 	<p>of the gear transmission system; Master the design of the geometric dimensions of each basic component in the planetary gear train.</p>	
<p>其它常用机构:</p> <ul style="list-style-type: none"> ● 棘轮机构, 槽轮机构, 不完全齿轮机构, 万向联轴器, 凸轮式间歇运动机构 <p>Other commonly used mechanisms:</p> <ul style="list-style-type: none"> ● Ratchet mechanism, sheave mechanism, incomplete gear mechanism, universal coupling, cam type intermittent motion mechanism 	<p>掌握棘轮机构、槽轮机构、不完全齿轮机构、万向联轴器的工作原理, 并了解其设计方法。</p> <p>Master the working principle of ratchet mechanism, sheave mechanism, incomplete gear mechanism and universal coupling, and understand their design methods.</p>	6
<p>机械的运转及其速度波动的调节:</p> <ul style="list-style-type: none"> ● 概述, 单自由度机械系统的等效动力学模型 ● 在已知力作用下机械的真实运动, 机械速度波动及其调节方法 <p>The operation of the machine and the regulation of its speed fluctuations:</p> <ul style="list-style-type: none"> ● Overview, equivalent dynamical model of a single-degree-of-freedom mechanical system ● The real movement of machinery under the action of known forces, the fluctuation of mechanical speed and the method of its regulation 	<p>掌握单自由度机械系统等效动力学模型的建立方法; 了解等效动力学模型的求解方法; 能够设计机械系统的调速飞轮。</p> <p>Master the method of establishing equivalent dynamic models of single-degree-of-freedom mechanical systems; understand how to solve equivalent kinetic models; be able to design speed-regulating flywheels for mechanical systems.</p>	2
<p>机械的平衡:</p> <ul style="list-style-type: none"> ● 概述, 刚性转子的静平衡及动平衡。 ● 刚性转子的平衡试验及平衡精度, 挠性转子动平衡简介, 平面机构的平衡简介 <p>Balance of machinery:</p> <ul style="list-style-type: none"> ● Overview, static balance and dynamic balance of rigid rotor. ● Balance test and balance accuracy of rigid rotor, introduction to dynamic balance of 	<p>掌握刚性转子静平衡、动平衡的设计计算; 掌握刚性转子的动平衡试验原理和方法; 了解挠性转子动平衡的原理及平面机构平衡的原理。</p> <p>Master the design and calculation of static balance and dynamic balance of rigid rotor; Master the principles and methods of dynamic balance test of rigid rotor; Understand the principle of dynamic balancing of flexible rotor and the principle of planar mechanism balancing.</p>	2

flexible rotor, introduction to balance of planar mechanism		
<p>机械的运动方案及机构的创新设计:</p> <ul style="list-style-type: none"> ● 概述, 机械运动方案设计原则 ● 原动机、传动机构及减速器的选择, 机构的运动协调及运动循环图 ● 机械运动方案拟定及评价, 机构运动方案设计实例, 机构的创新设计 <p>Innovative design of mechanical motion scheme and mechanism:</p> <ul style="list-style-type: none"> ● Overview, design principles for mechanical motion schemes ● Selection of prime mover, transmission mechanism and reducer, motion coordination and motion cycle diagram of the mechanism ● Formulation and evaluation of mechanical motion schemes, examples of mechanism motion scheme design, and innovative design of mechanisms 	<p>掌握机械系统运动方案的设计方法, 能够设计机械系统的运动方案; 了解机构创新设计的一般方法。</p> <p>Master the design method of the motion scheme of the mechanical system, and be able to design the motion scheme of the mechanical system; Learn about the general approach to innovative design for mechanisms.</p>	6

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

[1] 邓宗全, 于红英, 王知行主编《机械原理(第三版)》, 高等教育出版社, 2015年3月
[2] 陈明编著《机械原理课程设计》, 武汉: 华中科技大学出版社, 2014年6月
[3] 申永胜主编《机械原理教程》, 北京: 清华大学出版社, 2000年6月
[4] 孙桓 陈作模主编《机械原理(第七版)》北京: 高等教育出版社, 2006年10月
[5] 刘占山编. 机械原理实验教材. 哈工大教材科, 2015.9

19. 评估形式 Type of Assessment	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance	10	无 NA	
平时作业 Assignments	20	无 NA	
期末项目 Final Project	0	无 NA	
期末考试 Final Exam	70	无 NA	



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

