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**	**材料力学 M** **Mechanics of Materials - M**
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**	ME212
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**	秋季 Fall
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）**	徐少林 / 机械与能源工程系 / 13544221601 Xu Shaolin / Department of mechanical and energy engineering / 13544221601 魏艳/机械与能源工程系/15994806974 Yan Wei / Department of mechanical and energy engineering / 15994806974
9.	**实验员/助教、所属学系、联系方式** **Tutor/TA(s), Contact**	暂定助教 2-3 名
10.	**选课人数限额(可不填)** **Maximum Enrolment（Optional）**	40

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		0	0	48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	MA127 高等数学（下）
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

材料力学是机械类专业的一门主干课程，是基础课和专业课之间的桥梁，主要教学目标是培养学生在机械设计中有关力学设计和计算的能力。通过本课程的学习，了解构件的受力变形、破坏的规律，掌握构件力学设计计算的基本概念、基本理论、基本方法及其在工程中的应用，懂得进行外力分析、内力分析、应力分析、应力应变分析，通过材料力学的学习，能够对构件的强度、刚度和稳定性等问题有明确的基本概念、必要的基础知识、比较熟练的计算能力、一定的分析能力和初步的实践能力。

Mechanics of materials is a main course of mechanical majors, and it is a bridge between basic courses and professional courses. The main teaching goal is to cultivate students' ability in mechanical design by calculating and analyzing force and deformation of mechanical structures. Through the study of this course, students will understand the mechanisms of deformation and failure of components, master the related basic concepts, basic theories, basic methods of mechanical component design and their applications, know how to conduct external force analysis, internal force analysis, stress analysis, stress-strain analysis, finally have a clear basic concept, necessary basic knowledge, relatively proficient calculation ability, certain analysis ability and preliminary practical ability on issues such as the strength, stiffness and stability of mechanical components.

16. 预达学习成果 Learning Outcomes

通过本课程的学习，拟让学生掌握以下知识和能力：

（1） 具有将一般杆状结构构件简化为力学简图的初步能力；

（2） 分析、计算杆件在拉、压、剪切、扭转、弯曲时的内力，并做出相应的内力图；

（3） 熟练掌握杆件在各种基本变形形式下的应力和变形的理论计算方法；

（4） 能熟练运用强度、刚度条件对杆件进行校核和截面选择，能运用稳定条件对压杆进行稳定校核；

（5） 对能量法的基本原理和应用有初步的了解；

（6） 能掌握计算构件疲劳强度的方法，且对动载荷有初步的认识；

（7） 了解并掌握最基本的材料力学性能测试技术。

Through the study of this course, students will master the following knowledge and abilities:

(1) Possess the ability to simplify general rod-shaped structural parts into mechanical diagrams;

(2) Analyze and calculate the internal force of the rod during tension, compression, shearing, torsion and bending, and make corresponding internal force diagrams;

(3) Familiar with the theoretical calculation methods of stress and deformation of rods under various basic deformation forms;

(4) Can skillfully use the strength and stiffness conditions to check and select the section of the bar, and can use the stability condition to check the stability of the compression bar;

(5) Understand the basic principles and applications of the energy method;

(6) Be able to master the method of calculating the fatigue strength of components, and have a preliminary understanding of dynamic loading;

(7) Understand and master the most basic testing techniques for mechanical properties of materials.

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.)

绪论 Introduction（3 学时，3 hours）

材料力学基本任务与主要研究对象，变形固体及其基本假设，内力、应力、应变，杆件的基本变形。

Basic tasks and main research objects of materials mechanics, deformable body and its basic assumptions, internal force, stress, strain, and basic deformation of rob members.

轴向拉伸与压缩 Axial loads （3 学时，3 hours）

轴向拉、压杆件截面上的内力及应力，拉压杆的强度条件，轴向拉压时变形的计算，拉压静不定问题。

The internal force and stress on the cross section of rob under axial loading, the strength condition of the bar, the deformation calculation of rob, and statically indeterminate problems.

剪切与挤压，联接件的强度计算 Shear and extrusion, strength calculation of connector （3 学时，3 hours）

剪切和挤压力学模型、受力特征和变形特征，剪切和挤压时应力计算及联接件的设计。

Mechanical model of shear and extrusion, stress and deformation characterizations, stress calculation and design of connector

平面图形的几何性质 Geometrical property of plane figures（3 学时，3 hours）

静矩，惯性矩、极惯矩和惯性积，平行移轴公式，转轴公式，形心主轴，形心主惯性矩。

Static moment, inertia moment, polar moment of inertia, product of inertia, parallel axis formula, transformation formula, centroid axis, centroid principal moment of inertia.

扭转 Torsion（3 学时，3 hours）

扭转，纯剪切，剪应变，剪切虎克定律，极惯性矩和抗扭截面模量。

Torsion, pure shear, shear strain, Hooke's law of shear, polar moment of inertia, section modulus of torsion.

弯曲内力 Bending internal force（3 学时，3 hours）

平面弯曲，弯曲变形内力分析，截面上剪力和弯矩的计算。剪力图及弯矩图的绘制。

Bending, internal force analysis, shear force and bending moment, shear-force and bending-moment diagrams.

弯曲应力及梁的强度计算 Strength of beam （3 学时，3 hours）

对称梁纯弯曲，剪切弯曲的应力，梁弯曲的强度条件，组合变形的强度计算。

Pure bending of symmetrical beam, bending stress, strength condition of beam.

期中考试 Mid-term exam （3 学时，3 hours）

弯曲变形 Bending derformation （3 学时，3 hours）

梁挠曲线的近似微分方程，梁的挠度和转角的计算，梁的刚度条件。

Elastic/deflection curve, calculation of deflection and deflection angle, stiffness condition of beam.

应力状态理论及强度理论 Analysis of stress and strength theory（3 学时，3 hours）

应力状态，二向/三向/平面应力状态下的应力分析，强度理论。

Plane stress state, principal stress, stress analysis, strength theory.

组合变形下的强度计算 Combined loadings（3 学时，3 hours）

组合变形和叠加原理，拉伸或压缩与弯曲的组合，偏心压缩，扭转与弯曲的组合。

Combined loading, superimposing method, bi-axial loading, bending + axial load, torsion + bending.

能量法 Energy method（3 学时，3 hours）

外力功与应变能的计算，互等定理，卡氏第二定理，虚功原理，单位载荷法，冲击载荷。

Strain energy, elastic strain energy, reciprocal theorem, Castigliano's 2nd theorem, virtual work, unit load method, impact load.

超静定结构 Statically indeterminate structure（3 学时，3 hours）

力法、正则方程，连续梁及三弯矩方程。

Force method, canonical equation, continuous beam and three moment equation.

动载荷和交变应力 Dynamic load and alternating stress（3 学时，3 hours）

动载荷，交变应力作用下材料的疲劳破坏，交变应力的循环特征。构件的疲劳强度。

Dynamic load, fatigue damage under alternating stress, cycle symbol of alternating stress, fatigue limit.

压杆稳定的基本概念 Columns（3 学时，3 hours）

压杆弹性平衡稳定性，细长压杆的临界荷载，欧拉公式，压杆稳定计算(折减系数法)。

Stability of columns, Euler's formula for beams, stability enhancing and design.

专题与提高部分 Special topic （3 学时，3 hours）

结构的疲劳破坏与分析，冲击问题，薄壁与厚壁圆筒的分析。

Analysis of fatigue failure, impact loading problems, analysis of thin-wall and thick-wall cylinders.

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

教材：刘鸿文主编，《材料力学（第五版）》，高等教育出版社，2010

参考书：James M. Gere, Barry J. Goodno - Mechanics of Materials, SI Edition-CL Engineering (2012)

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		
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		30		
期中考试 Mid-Term Test		20		
期末考试 Final Exam		40		
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