南方科技大学 SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

# 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.

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| 1. | **课程名称 Course Title** | **材料力学　Mechanics of Materials** |
| 2. | **授课院系 Originating Department** | 力学与航空航天工程系 Department of Mechanics and Aerospace Engineering |
| 3. | **课程编号 Course Code** | MAE202 |
| 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 |
| 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）** | 王敏 助理教授<br>力学与航空航天工程系<br>wangm@sustech.edu.cn<br><br>Min Wang Assistant Professor<br>Department of Mechanics and Aerospace Engineering<br>wangm@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）** | |

| 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 |

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| 12. | 先修课程、其它学习要求<br>**Pre-requisites or Other Academic Requirements** | MA102B 高等数学（下） 或者 MA102A 数学分析 II 且 MA104b 线性代数 II<br>MA102B Calculus II A / MA102A Mathematical Analysis II<br>& MA104b Linear Algebra II |
| 13. | 后续课程、其它学习规划<br>**Courses for which this course is a pre-requisite** | 弹性力学，固体力学实验，机械设计基础，航空结构强度实验等 |
| 14. | 其它要求修读本课程的学系<br>**Cross-listing Dept.** | 机械与能源工程系 |

## 教学大纲及教学日历 SYLLABUS

### 15. 教学目标 Course Objectives

材料力学是一门工科类专业的重要的基础必修课程。通过对本课程的学习，使学生对杆件的强度、刚度和稳定性问题具有明确的基本概念、必要的基础知识、较熟练的计算能力以及一定的分析能力和初步的实验能力。培养学生的力学素质和定性定量分析能力，为学生学习相关专业课程及进行结构设计和科学研究奠定良好的基础。

材料力学教学要强化力学的基本概念和基础理论的教学；强调与工程背景的密切结合。

课程的主要内容包括：杆件的内力分析、应力分析、应力状态分析、位移分析、强度分析与设计、刚度分析与设计、压杆的稳定性分析与设计、能量原理与应用、疲劳失效分析与设计、复合材料的力学行为等。

Mechanics of materials is an important basic compulsory course for engineering majors. Through the study of this course, the students will understand the basic concepts and knowledge of the strength, stiffness and stability problems of rob, and therefore obtain explicit calculation ability, skilled analysis ability and experimental ability. The course is intended to train students' mechanical quality and qualitative and quantitative analysis ability, laying a good foundation for students to study related courses and structure design and scientific research.

The teaching of material mechanics should strengthen the teaching of the basic concepts and the basic theory of mechanics, and emphasize the close combination with engineering background.

The main contents include: bar internal force analysis, stress analysis, stress analysis, displacement analysis, strength analysis and design, stiffness analysis and design, column stability analysis and design, energy method and application, fatigue failure analysis and design, mechanical behaviour of composite materials.

### 16. 预达学习成果 Learning Outcomes

通过课堂教学和后续的实践训练环节，使学生掌握变形体力学分析中最基本的概念、原理和方法及其在工程中的应用，培养学生判断工程中强度、刚度和稳定性问题的能力。同时，训练学生将具体研究对象抽象化、理想化，并建立正确的物理模型和数学模型的能力。为后续课程的学习、知识结构的完善及科学思维能力的训练奠定基础。

Through classroom teaching and the subsequent practice training, the students will master the most basic concept, principle and method of the deformable body's mechanical analysis, and therefore acquire the ability to judge the strength, stiffness and stability of the structural member. Meanwhile, students are trained to abstract and idealize specific subjects, and to establish the correct physical model and mathematical model. It lays the foundation for the following course study, the improvement of knowledge structure and the training of scientific thinking ability.

### 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.)**

Lesson 1: 绪论 Introduction （3 学时/3 credit 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.

Lesson 2: 轴向拉伸与压缩 Axial loads（3 学时/3 credit 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.

Lesson 3: 剪切与挤压，联接件的强度计算 Shear and extrusion, strength calculation of connector（3 学时/3 credit 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

Lesson 4: 平面图形的几何性质 Geometrical property of plane figures（3 学时/3 credit 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.

Lesson 5: 扭转 Torsion（3 学时/3 credit 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.

Lesson 6: 弯曲内力 Bending internal force（3 学时/3 credit 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.

Lesson 7: 弯曲应力及梁的强度计算 Strength of beam（3 学时/3 credit 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.

Lesson 8: 期中考试 Mid-term exam（2 学时/2 credit hours）

Lesson 9: 弯曲变形 Bending derformation（3 学时/3 credit 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.

Lesson 10: 应力状态理论及强度理论 Analysis of stress and strength theory（3 学时/3 credit 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.

Lesson 11: 组合变形下的强度计算 Combined loadings（3 学时/3 credit 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.

Lesson 12: 能量法 Energy method（3 学时/3 credit 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.

Lesson 13: 超静定结构 Statically indeterminate structure（3 学时/3 credit 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.

Lesson 14: 动载荷和交变应力 Dynamic load and alternating stress（3 学时/3 credit 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.

Lesson 15: 压杆稳定的基本概念 Columns（3 学时/3 credit 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.

Lesson 16: 专题与提高部分 Special topic（4 学时/4 credit 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（第四版）》，高等教育出版社，2004

参考书目：

[1]孙训方，方孝淑，关来泰编，《材料力学（第四版）》，高等教育出版社，2004

[2]武建华等，《材料力学》，重庆大学出版社，2004

[3]范钦珊等，《工程力学》，高等教育出版社，2004

[4]R. C. Hibbele,《材料力学（第五版）》，高等教育出版社，2004

[5]James M.Gere，Barry J.Goodno,《材料力学(英文版)(原书第 7 版)》, 机械工业出版社, 2011

[6]S. P. Timoshenko, J. M. Gere,《Mechanics of Materials (3rd edition)》, 1991

## 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 | | | | |
| 课堂表现 Class Performance | | 10 | | |
| 小测验 Quiz | | | | |
| 课程项目 Projects | | | | |
| 平时作业 Assignments | | 20 | 抄袭平时作业记 0 分 Cheating: 0 | |
| 期中考试 Mid-Term Test | | 30 | 考试作弊本门课程记 0 分 Cheating: 0 | |
| 期末考试 Final Exam | | 40 | 考试作弊本门课程记 0 分 Cheating: 0 | |
| 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

力学与航空航天工程系教学指导委员会

The commission of teaching instruction in department of mechanics and aerospace engineering