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**	工程力学 Engineering Mechanics
2.	**授课院系** **Originating Department**	海洋科学与工程系 Department of Ocean Science and Engineering
3.	**课程编号** **Course Code**	OCE215
4.	**课程学分 Credit Value**	4
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**	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）**	陈建飞 海洋科学与工程系 工学院南楼 209，0755-88015269 Prof. Jian Fei CHEN, Department of Ocean Sciences and Engineering College of Engineering 209, 0755-88015269
9.	**实验员/助教、所属学系、联系方式** **Tutor/TA(s), Contact**	无 NA
10.	**选课人数限额(可不填)** **Maximum Enrolment（Optional）**	30

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	64				64

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	高等数学 II（MA127）
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite	结构分析、弹性力学、有限元法等
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

《工程力学》是海洋工程与技术专业的一门重要专业基础课，它为本专业学生学习后续相关课程和将来从事科学技术工作奠定必要的基础。它包括静力学、材料力学、动力学等内容。通过工程力学的教学，将达到以下教学目标：

1. 掌握力学基本理论，包括静力学、动力学和材料力学等方面的知识；
2. 具备分析工程问题的能力，能够运用力学理论和方法解决实际问题；
3. 培养工程意识和工程实践能力，提高团队协作和沟通能力；
4. 激发对工程力学的兴趣和爱好，培养自主学习和创新能力。

"Engineering Mechanics" is an important technical foundational course for many engineering disciplines. It not only forms the basis of the entire discipline of mechanics but also lays necessary groundwork for students in related majors to study subsequent courses and engage in future scientific and technological work. It includes topics such as statics, material mechanics, and dynamics. Through the teaching of engineering mechanics, the following educational objectives will be achieved:

1. Mastery of the fundamental theories of mechanics, including knowledge in statics, material mechanics, dynamics, etc.
2. Ability to analyze engineering problems, using mechanical theories and methods to solve practical issues.
3. Cultivation of engineering awareness and practical abilities, enhancing teamwork and communication skills.
4. Stimulating interest and enthusiasm for Engineering Mechanics, fostering self-learning and innovation capabilities.

16. 预达学习成果 Learning Outcomes

工程力学课程预期达到的学习成果主要包括以下几个方面：

一、力学基础知识
1. 掌握牛顿运动定律及其应用；
2. 理解矢量运算及力学中的基本物理量，如力、速度、加速度、动量、动能等；
3. 掌握基本的力学单位和换算。

二、静力学原理与应用
1. 理解静力学的基本原理，包括力的平衡、力矩、力偶等；
2. 掌握刚体静力学问题的分析方法，如平面汇交力系、平面力偶系、平面任意力系等；
3. 掌握静力学在日常生活、工程实践中的应用，如桥梁设计、建筑物稳定性分析等。

三、材料力学
1. 理解材料的力学性质，如强度、刚度、稳定性等；
2. 理解不同工程材料的力学特性及其应用场景；
3. 掌握变形体的基本概念，如应力、应变、弹性模量、泊松比等；
4. 掌握构件轴力、剪力、扭矩和弯矩的计算方法，以及剪力图和弯矩图的绘制方法；
5. 理解应力状态、强度理论和疲劳强度等相关概念。

四、动力学基础
1. 理解动力学的基本概念，如动量定理、动量守恒定律、动能定理等；
2. 掌握动力学问题的分析方法，如质点动力学、刚体动力学等。

通过以上学习成果的实现，学生将能够全面掌握工程力学的基本理论和技能，为未来的工程实践、科学研究和工作奠定坚实的基础。

The expected learning outcomes of the Engineering Mechanics course mainly include the following aspects:

I. Fundamentals of Mechanics
1. Mastery of Newton's laws of motion and their applications；
2. Understanding of vector operations and basic physical quantities in mechanics, such as force, velocity, acceleration, momentum, kinetic energy, etc.
3. Mastery of basic mechanics units and conversions.

II. Principles and Applications of Statics
1. Understanding the basic principles of statics, including force equilibrium, moment and couple；
2. Mastery of analytical methods for statics problems of rigid bodies, such as coplanar force systems, coplanar couple systems, and arbitrary coplanar force systems；
3. Mastery of the application of statics in daily life and engineering practice, such as bridge design, stability analysis of structures, etc.

III. Material Mechanics
1. Understanding the mechanical properties of materials, such as strength, stiffness and stability etc.;
2. Understanding the mechanical characteristics and applications of different engineering materials;
3. Mastery of the basic theory and calculation methods of material mechanics, such as stress, strain, modulus of elasticity, Poisson's ratio, etc.

IV. Fundamentals of Dynamics
1. Understanding the basic concepts of dynamics, such as the theorem of momentum, the law of conservation of momentum, the theorem of kinetic energy, etc.;
2. Mastery of analytical methods for dynamic problems, such as particle dynamics, rigid body dynamics, etc.

Through the achievement of these learning outcomes, students will be able to comprehensively grasp the fundamental theories and skills of Engineering Mechanics, laying a solid foundation for engineering practice, scientific research, and career in the future.

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.)

本课程分为四部分 / this course includes the following three parts：

1. 课程绪论/Introduction: 2 学时 / 2 hours
2. 静力学/Static: 24 学时 / 24 hours
3. 材料力学/Mechanic of materials: 34 学时 / 34 hours
4. 动力学/Dynamics: 4 学时 / 4 hours

总计/ Total: 64 学时 / 64 hours

Part 1 课程绪论（2 学时）
课程介绍，工程力学的研究对象和任务，研究内容和方法

Part 2 静力学(24 学时)

题目 1 静力学一般原理（2 学时）
静力学基本概念，计量单位、国际制单位、数值计算、一般分析步骤

题目 2 力矢量（4 学时）
标量与矢量、矢量运算、力矢量的合成、共面力的合成等

题目 3 力系的平衡方程（4 学时）
力系的平衡条件、平面力系、空间力系

题目 4 力系的合成（4 学时）
力矩-标量公式、叉乘、力矩-矢量公式、力矩原理、力对指定轴的力矩、力偶、力和力偶的简化

题目 5 刚体平衡（4 学时）
刚体平衡条件、隔离体、平衡方程、二力和三力杆、约束和几何分析

题目 6 结构分析（4 学时）
简单桁架、结点法、零杆、截面法、空间桁架、框架和机械

题目 7 摩擦（2 学时）
干摩擦特性等

Part 3 材料力学(34 学时)

题目 1 拉伸、压缩和剪切（4 学时）
正应力和切应力，正应变和切应变，弹性，塑性，胡克定律，杆件变形的基本形式

题目 2　轴向受力杆件（4 学时）
轴力与轴力图，拉压杆的应力和圣维南原理，材料拉伸、压缩时的力学性能，应力集中的概念，拉压杆的强度计算，拉压杆的变形计算

题目 3　扭转（4 学时）
扭矩与扭矩图，薄壁圆筒的扭转，切应力互等定理，圆轴的扭转应力与强度条件，圆轴扭转变形与刚度计算，非圆截面轴扭转简介

题目 4　剪力和弯矩（4 学时）
剪力弯矩概念，剪力图和弯矩图，荷载、剪力和弯矩关系

题目 5　弯曲应力（4 学时）
梁的弯曲正应力，梁的弯曲切应力，梁的曲率，梁的弯曲应力设计

题目 6　应力应变分析（4 学时）
平面应力，主应力，最大切应力，莫尔圆，平面应变，三向应力状态，胡克定律

题目 7　梁的挠度（4 学时）
基本概念、挠度曲线微分方程、积分法求梁的变形、叠加法、面积法

题目 8　超静定梁（4 学时）
超静定梁的类型，挠度曲线微分方程分析，叠加法

题目 9　压杆稳定（2 学时）
屈曲和稳定性概念，带销端的柱，具有其他支撑条件的柱，带有偏心轴向载荷的柱，弹性和非弹性柱行为，压杆的稳定性计算

Part 4　动力学(4 学时)

题目 1：质点动力学基本定理、动量定理、动量矩定理、动能定理（4 学时）
动力学基本定律、质点运动微分方程、动力学普遍方程、动量定理及其应用、动量矩定理与动量矩守恒定律、动能定理及其应用等

Part 1　Introduction of the course (2 hours)
Introduction to the course, the object and task of Engineering Mechanics, research content and methods.

Part 2 Static (26 hours)

Topic 1: General Principles of Statics (2 hours)
Fundamental concepts, units of measurement, the international system of units, numerical calculations, general procedure for analysis

Topic 2: Force Vectors (4 hours)
Scalars and vectors, vector operations, vector addition of forces, addition of a system of coplanar forces, etc.

Topic 3: Equilibrium of a Particle (4 hours)
Condition for the equilibrium of a particle, coplanar force systems, three-dimensional force systems

Topic 4: Force System Resultants (4 hours)
Moment of a force-scalar formulation, cross product, moment of a force-vector formulation, principle of moments, moment of a force about a specified axis, moment of a couple, simplification of a force and couple

Topic 5: Equilibrium of a Rigid Body (4 hours)

Conditions for rigid-body equilibrium, free-body diagrams, equations of equilibrium, two- and three-force members, constraints and statical determinacy

Topic 6: Structural Analysis (4 hours)
Simple trusses, the method of joints, zero-force members, the method of sections, space trusses, frames and machines

Topic 7: Friction (2 hours)
Characteristics of dry friction etc.

Part 3 Mechanic of materials (34 hours)

Topic 1: Tension, Compression, and Shear (4 hours)
Normal stress and shear stress, normal strain and shear strain, elasticity, plasticity, Hooke's Law, basic forms of deformation of members.

Topic 2: Axially Loaded Members (4 hours)
Axial forces and force diagrams, stress and Saint-Venant's principle for tension and compression members, mechanical properties during tension and compression, concept of stress concentration, strength calculation and deformation calculation of tension and compression members.

Title 3: Torsion (4 hours)
Torque and torque diagrams, torsion of thin-walled cylinders, theory of shear stress equivalence, torsional stress and strength conditions of circular shafts, calculation of torsional deformation and stiffness of circular shafts, brief introduction to torsion of non-circular cross-section shafts.

Title 3: Shear Forces and Bending Moments (4 hours)
Concepts of shear and compression, shear-force and bending-moment diagrams, relationships among loads, shear forces, and bending moments.

Title 6: Stresses in beams (4 hours)
Bending normal stress of the beam, bending shear stress of the beam, beam curvature, design of beams for bending stresses

Title 6: Analysis of Stress and Strain (4 hours)
Plane stress, principal stresses, maximum shear stresses, Mohr's Circle, plane strain, triaxial stress state, Hooke's law

Title 7: Deflections of Beams (4 hours)
Basic concepts, differential equations of the deflection curve, deflections by integration of the bending-moment equation, method of superposition, moment-area method

Title 7: Statically Indeterminate Beams (4 hours)
Types of statically indeterminate beams, analysis by the differential equations of the deflection curve, method of superposition

Title 10: Columns (2 hours)
Concept of buckling and stability, columns with pinned ends, columns with other support conditions, columns with eccentric axial loads, elastic and inelastic column behavior, design formulas for columns

Part 4 Dynamics (2 hours)

Topic 1: Basic Theorems of Particle Dynamics, Momentum Theorem, Moment of Momentum Theorem, Kinetic Energy Theorem (4 hours)
Basic laws of dynamics, differential equations of particle motion, general equations of dynamics, momentum theorem and its applications, moment of momentum theorem and conservation of moment of momentum, kinetic energy theorem and its applications.

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

教材：
[1] Hibbeler, R. C. Engineering Mechanics. Statics and Dynamics. Fourteenth edition. Hoboken: Pearson, 2016.
[2] Goodno, Barry J., and James M. Gere. Mechanics of Materials. Enhanced ninth edition. Boston, MA: Cengage, 2021.

其它参考资料：
[1] 孙艳, 史慧云. 工程力学. 第 2 版. 北京: 中国电力出版社, 2015.
[2] 杨静宁. 工程力学. 第 2 版. 北京: 科学出版社, 2015.
[3] 张明宇. 工程力学. 哈尔滨: 哈尔滨工程大学出版社, 2022.
[4] 张力. 工程力学. 第 2 版. 北京: 清华大学出版社, 2011.
[5] 范钦珊. 工程力学. 第 2 版. 北京: 高等教育出版社, 2011.

《理论力学》哈尔滨工业大学出版；《材料力学》浙江大学出版 各类理论力学，材料力学习题解答

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		10		
小测验 Quiz				
课程项目 Projects				

平时作业 **Assignments**		20		
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

教学负责人签字：
日期：