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**	海洋工程水动力学 Offshore Hydrodynamics
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**	OCE207
4.	**课程学分 Credit Value**	3
5.	**课程类别 Course Type**	专业选修课 Major Elective 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）**	冯兴亚 海洋科学与工程系 创园 9 栋 212，18219445515 Dr. Xingya Feng, Department of Ocean Sciences and Engineering Chuang Yuan #9-212, 18219445515
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）**	

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

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	MA102B 高等数学（下）A Calculus II A PHY105B 大学物理（下）B General Physics B (II)
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

本课程使学生能够掌握海洋工程水波动力学相关的基本概念和基础理论，理解、解释水波现象，分析海洋波浪运动规律，掌握波浪在海工结构物上的作用力计算，掌握浮体在波浪中的运动响应计算，为今后从事海洋科学与工程相关领域工作和研究打好理论基础，并且培养学生从事海洋分析和设计的技术能力

This course shall equip the students with basic concepts and fundamentals of offshore hydrodynamics. Students will be trained to understand the dynamics and kinematics of phenomena relevant to ocean waves, and to calculate wave loads on offshore structures and motions of floating bodies. This course helps students lay a foundation for work and study in ocean science and engineering in the future, and it builds up students' abilities and skills to carry out analysis and design for fixed and floating facilities in the ocean.

16. 预达学习成果 Learning Outcomes

通过本课程的学习，学生将掌握以下内容：水波基本概念理解及其在海洋工程中应用，水静力分析计算，水波原理，波浪的传播与变形分析，波浪载荷计算，浮体在波浪中的运动分析。

Upon completion of this course, students will obtain the following knowledge and skills：Basic concepts of fluid flow and its applications in marine offshore engineering; Hydrostatics; Motion of a real fluid; Potential flow theory; Linear water wave theory; Wave propagation and deformation; Wave loads; Motions of floating body.

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.)

本课程以英文授课为主，以中文为辅助解释，帮助学生理解。

Section 1　　课程与学科介绍：（2 学时）

a) 水力学和水波动力学的内容、发展及其应用; b) 流体基本性质

Introduction: a) the development, history and applications of hydraulics and hydrodynamics; b) fluid properties (2 hours)

Section 2　　水静力学基础：（4 学时）

液体中静水压强计算，液体内作用于平面上的静水压力，作用于曲面上的静水压力，浮力的计算，浮体稳定性的概念。

Fundamentals of hydrostatics: hydrostatic pressure, static force on flat plate and curved plate, buoyancy force, stability of floating body (4 hours)

Section 3　　水动力学基础: （4 学时）

质量守恒、动量守恒方程的导出; 雷诺传输定理介绍；连续介质方程推导；欧拉方程， Navier-Stokes 方程推导。

Fundamentals of Hydrodynamics: Conservation of mass and momentum; Reynolds transport theorem; Continuity equation; Euler's equation; N-S equation. (4 hours)

Section 4　　管流和能量守恒定律: （4 学时）

管道流动分布计算；能量守恒定律在管流中的应用；雷诺数，层流、紊流介绍；。

Pipe flow and conservation of energy in pipe flow: Flow distribution in pipe; application of conservation of energy in pipe flow; introduction to concepts of Reynolds number, laminar and turbulent flow.(4 hours)

Section 5　　平板流动及边界层理论: （4 学时）

平板边界层动量积分方程及其平板边界层的计算, 边界层排挤厚度；平板流动层流边界层、紊流边界层；流动分离和拖曳力。

Flow on plate and boundary layer theory: Momentum integral equation of steady flow over a flat plate, displacement thickness; Laminar boundary layer and turbulent boundary layer over a flat plat; flow separation and drag force. (4 hours)

Section 6　　理想流体势流理论: （4 学时）

理想流体无旋流动，速度势的概念；Laplace 方程，非定常伯努利方程；流函数概念及其与速度势的关系；简单势流的速度势、速度和压力表达；附加质量和附加惯性力的概念。

Theory of an ideal potential flow: Irrotational flow and velocity potential; Laplace equation and unsteady flow Bernoulli equation; Stream function; simple potential flow and its properties; Introduction to concepts of added mass and inertial force. (4 hours)

Section 7　　波浪理论（6 学时）

波浪控制方程，边界条件，线性化自由水面边界条件，线性波浪理论，波浪线性叠加原理，群速度，波

能

Wave theory: Governing equations for ocean waves, boundary conditions; Linear wave theory; Superposition of plane waves; wave group velocity; wave energy. (6 hours)

Section 8　　海洋波浪统计和描述：（3 学时）

非规则波及其统计和分析，波谱的概念，工程实践中常用的波浪谱。

Ocean wave and statistical description: Irregular waves and simple statistical analysis; introduction to concept of wave spectrum; introduction to some standard wave spectra used in engineering practice. (3 hours)

Section 9　　波浪对海洋结构物的作用力：（6 学时）

势流中波浪惯性力的计算；Morison 方程，圆柱波浪荷载的计算；惯性力系数和阻尼系数。

Wave loads on offshore structures: Computation of wave inertial force in potential flow; Morison equation and wave loads on circular cylinder; coefficients of inertial force and drag force. (6 hours)

Section 10　　浮体在波浪中的运动：（6 学时）

浮体在波浪中的运动方程，浮体在水中的附加质量、辐射阻尼、刚度矩阵，浮体运动响应

Motions of a floating body in waves: Motions of equation, added mass, radiation damping, hydrostatic stiffness, responses of a floating body. (6 hours)

Section 11　　课程设计小项目展示：（3 学时）

学生将分组展示指定海洋环境下海洋工程的初步设计：海工结构的选型与环境荷载计算。

Mini design project presentation: Students will present their group design of their offshore structures: choice of offshore structures types and environmental loading calculation. (3 hours)

Section 12　　课程总结与串联（2 学时）

课程内容复习；绘制知识图谱；复习与串联。

Review of the course: Review of the topics covered in this course; Revision and reflection. (2 hours)

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

教材：

1. J.N. Newman, Marine Hydrodynamics. Cambridge, MA: The MIT Press, 2015.

参考资料：

2. Robert G. Dean, Robert A. Dalrymple, Water wave mechanics for engineers and scientists. World Scientific, 1991.

3. E. John Finnemore and Joseph B. Franzini, Fluid Mechanics with Engineering Applications, McGraw-Hill, 2001.

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

海洋科学与工程系本科教学委员会
Department of Ocean Science and Engineering Undergraduate Committee