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.

1.	课程名称 Course Title	**物理海洋学 Physical Oceanography**
2.	授课院系 Originating Department	海洋科学与工程系 Department of Science and Engineering
3.	课程编号 Course Code	OCE305
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）	刘志强，海洋科学与工程系，17620783566 Zhiqiang LIU/Department of Ocean Science and Engineering
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**	OCE201 海洋科学导论 Introduction to Oceanography
13.	后续课程、其它学习规划 **Courses for which this course is a pre-requisite**	OCE471 海上实习 Marine Cruises
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**

本课程较全面、系统地介绍物理海洋学的基本理论、研究方法和应用实例，重点讲解海洋环流控制方程及物理意义，海洋环流的时空尺度，大洋风生和热盐环流的基本结构和动力过程，海盆-陆坡-陆架环流的基本特征和动力过程及海洋中的波动现象。本课程要求学生较全面掌握物理海洋学的基本理论与研究方法，为开展海洋科学研究打好基础。

This course introduces the fundamentals of physical oceanography, including governing equations, physics and dynamics, as well as methodology and applications. This course will emphasize these following contents: 1) governing equations of ocean circulation and their dynamics interpretation; 2) temporal and spatial scale of ocean circulations; 3) wind-driven and thermohaline circulation in the global ocean; 4) the cross-scale basin-slope-shelf circulations; and 5) waves and tides in the ocean. Students are required to understand the mathematics of those theories, their dynamics implementation, especially their realistic/theoretical applications in understanding the multiscale processes in the ocean.

16. **预达学习成果 Learning Outcomes**

本课程在高年级以双语授课，要求学生掌握物理海洋学基本理论及其数学表述和动力解析，要求学生可以将基本动力学理论应用于多尺度海洋现象、过程的解析中，同时具备基本的观察、分析、解释海洋动力过程的研究能力。课程中涉及物理海洋学基本数据的获取和数值分析等实践内容，与理论学习相互补充，拓展学生的研究能力。

This course will be delivered in both Chinese and English for upper-division undergraduates (mostly seniors after year 2) and graduate students, and by the end of the semester, students are expected to fully understand not only the basic theories about ocean circulations, but also their mathematics and dynamics interpretation. Students are also expected to apply these theories to study the multiscale processes in the ocean circulation, and build the capability to observe, analyze and explain the physical oceanographic phenomenon. This course will also evolve the technologies of ocean observations and numerical analyses, as essential complementary practices to help the students better understand those theories.

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.)

1. 绪论 （3 学时）

Introduction (3 credit hours)

物理海洋学的研究对象，方法，历史和全球海洋分布。

Definition of physical oceanography, the related technologies and historical settings, as well as characteristic of global oceans.

2. 海洋大气强迫和热收支（3 学时）

Atmospheric Influences and Ocean Heat Budget (3 credit hours)

全球风场分布、各大洋海气界面的热量和淡水通量及上层海洋热收支

Overview of winds, atmospheric heat and buoyancy fluxes of the global ocean, as well as their impacts on the heat content of the upper oceans.

3. 海水的温度、盐度和密度（4 学时）

Temperature, salinity and density (4 credit hours)

物理海洋学中海水性质的定义，盐度，温度，密度和位密及其随深度变化，海洋中的上混合层和密度跃层。

Hydrographic properties of ocean waters, definition of salinity, temperature, density, potential density and their interpretation, the typical vertical distribution of these properties in the open ocean and their linkages. Evolution of mixed layer, as well as formation and variation of isopycnal.

4. 海洋环流的控制方程（8 学时）

The equations of motion (8 credit hours)

连续、动量方程和温、盐度的对流扩散方程，尺度分析，海洋环流的主要驱动力和海洋过程的响应。

Continuity, momentum and transport-diffusion equations of ocean circulation, scale analysis, as well as dominant forces of ocean dynamics.

5. 上层海洋对风的响应（3 学时）

Response of the upper ocean to winds (3 credit hours)

惯性流和艾克曼流的理论解的和物理意义

Inertial motion, Ekman spiral and mass transport as well as their associated mathematics and physics.

6. 海洋中的地转过程（3 学时）

Geostrophic circulation (3 credit hours)

地转平衡及其对解释上层和深层海洋环流状态的重要性

Geostrophic balance and dynamics and their importance in understanding the general characteristics of ocean circulation in both the upper and deep layers.

7. 风生大洋环流的理论（7 学时）

Wind-driven ocean circulation (7 credit hours)

风生大洋环流的 Sverdrup, Stommel 和 Munk 解，及其观测验证，全球大洋中的西边界流。

Sverdrup, Stommel and Munk's theoretical solutions on the wind-driven ocean circulations and their observational evidences, western boundary currents in the world's oceans.

8. 海洋环流的涡度（4 学时）

Vorticity of the ocean circulation (4 credit hours)

Stocks 理论，涡度的定义，位涡守恒，艾克曼抽吸和风生大洋环流理论的涡度解

Stocks theorem, relative and potential vorticity, Ekman pumping and the vorticity prospective of wind-driven ocean circulation.

9. 大洋深层环流（4 学时）

Deep ocean circulation (3 credit hours)

大洋深层环流特征、理论解释、现场观测和对全球气候的重要意义

Deep circulation in the ocean, theories and observations, global ocean conveyor belt and its climate importance.

10. 低纬度海洋环流和厄尔尼诺（4 学时）

Low-latitude ocean circulations and El Nino (4 credit hours)

低纬度海洋环流的动力特征和气候尺度变异，厄尔尼诺现象和全球意义

The low-latitude ocean circulation, its variability and climate impacts, El Nino and its teleconnections.

11. 潮汐和近岸过程（5 学时）

Tides and coastal processes (5 credit hours)

平衡潮理论，主要分潮和全球潮汐分布，调和分析，陆架、近岸环流的地转和非地转成分，底边界层，近岸上升流和下降流

Theory of ocean tides, major tidal constituents and global distribution, harmonic analysis and its dynamics meaning, shelf and coastal processes, importance of geostrophy, bottom boundary layer, upwelling and downwelling.

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

1. 吕华庆，物理海洋学基础，海洋出版社，2012

2. Stewart, R.H., Introduction to Physical Oceanography. Open Textbook Library. 2008

3. Gill, A. E., Atmospheric-Ocean Dynamics. New York, Academic Press, 1982

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		15		
期中考试 Mid-Term Test		25		
期末考试 Final Exam		50		
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