

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	航空热流体实验 Aero-Thermal Fluid Lab
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	MAE315
4.	课程学分 Credit Value	2
5.	课程类别 Course Type	专业核心课 Major Core 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)	曹人靖 产学研教授 力学与航空航天工程系 caorj@sustech.edu.cn Cao Renjing Professor Department of Mechanics and Aerospace Engineering caorj@sustech.edu.cn
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	赵晓争 实验员 力学与航空航天工程系 zhaoxz@sustech.edu.cn ZHAO Xiaozheng Tutor Department of Mechanics and Aerospace Engineering zhaoxz@sustech.edu.cn
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	8		56		64
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	工程流体力学 Engineering Fluid Mechanics (MAE207) 或 流体力学 Fluid Mechanics (MAE303) + 工程热力学 Engineering Thermodynamics (MAE305) 或 传热学 Heat Transfer (MAE308)				
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

- 帮助学生熟悉航空领域相关的流体力学和热力学实验的基本知识与操作；
- 通过实际的实验操作增强学生对流体力学和热力学知识的理解；
- 训练学生掌握基本流体力学和热力学实验操作，以及如何处理与分析实验数据；
- 学习如何团队合作以及设计创新型实验装置。
- To familiarize students with fundamentals and experimental skills of fluid mechanics and thermodynamics experiments associated with aerospace engineering;
- To improve the understanding of fluid mechanics and thermodynamics knowledge through practical lab experiments;
- To train students with practicing in hands-on fundamental fluid mechanics and thermodynamics experiments, along with data acquisition, processing and experimental data analysis;
- To provide students with experience of team-works and designing innovative experimental rigs as a collaborative group.

16. 预达学习成果 Learning Outcomes

顺利完成本课程学习后，学生们将会：

- 认识到实验研究在航空领域的重要性，提高理论与实验结合的能力；
- 理解并有能力独立操作基本风洞和传热实验，处理和分析实验数据、以及撰写实验报告；
- 运用理论与实验知识设计实际的实验方案；
- 通过团队协作认识到团队意识与沟通等技能的重要性。

On successful completion of the course, students will be able to:

- Appreciate the importance of lab experiments associated with aerospace engineering, and improve the ability of utilizing theory and practice together;
- Being able to understand and operate fundamental wind tunnel and heat transfer experiments, data processing and analysis of experimental data, and write up lab reports independently and completely;
- Design practical experimental approach by using knowledge of learned theories and experiments;
- Appreciate the importance of teamwork, communication through a collaborative group working.

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.)

第 1 周 课程介绍和流体力学实验原理（4 课时）

课程概述、实验操作、团队设计项目介绍（1 小时）

流体、流动测试技术与方法（3 小时）

第 2 周 热力学实验原理（4 课时）

热、传热、传质测试技术与方法（4 小时）

第 3 周 操作实验（4 课时）

风洞基本操作与毕托管测速实验 实验讲解（1 小时）

风洞基本操作与毕托管测速实验 实验操作（3 小时）

第 4 周 操作实验（4 课时）

圆柱绕流实验 实验讲解（1 小时）

圆柱绕流实验 实验操作（3 小时）

第 5 周 操作实验（4 课时）

流线体和钝体阻力测试实验 实验讲解（1 小时）

流线体和钝体阻力测试实验 实验操作（3 小时）

第 6 周 操作实验（4 课时）

翼型流场、压力分布、升阻比测定实验 实验讲解（1 小时）

翼型流场、压力分布、升阻比测定实验 实验操作（3 小时）

第7周 操作实验（4课时）

边界层测量实验 实验讲解（1小时）

边界层测量实验 实验操作（3小时）

第8周 演示操作实验（4课时）

热线风速仪与 PIV 实验 实验讲解（1小时）

热线风速仪与 PIV 实验 演示操作（3小时）

第9周 操作实验（4课时）

热传导系数测定实验 实验讲解（1小时）

热传导系数测定实验 实验操作（3小时）

第10周 操作实验（4课时）

对流传热实验 实验讲解（1小时）

对流传热实验 实验操作（3小时）

第11周 操作实验（4课时）

辐射传热实验 实验讲解（1小时）

辐射传热实验 实验操作（3小时）

第12周 操作实验（4课时）

热管换热器实验 实验讲解（1小时）

热管换热器实验 实验操作（3小时）

第13周 演示实验+团队设计项目（4课时）

流动、燃烧等演示实验（2小时）

团队项目设计讨论（2小时）

第14-15周 团队设计项目（8课时）

根据团队设计项目计划完成设计与制作（4小时 x2）

第16周 操作实验（4课时）

各小组做项目展示与陈述（4小时）

Week 1 Course Introduction and principle on fluid mechanics experiments (4 hours)

Course overview, lab experiments, group design project (1 hour)

Fluid and flow measurement techniques and methods (3 hours)

Week 2 Theory on experimental thermodynamics (4 hours)

Techniques and methods on heat, heat transfer and mass transfer (4 hours)

Week 3 Hands-on practice of lab experiments (4 hours)

Basic operation of wind tunnel and Pitot wind speed experiment Introduction (1 hour)

Basic operation of wind tunnel and Pitot wind speed experiment Operation (3 hours)

Week 4 Hands-on practice of lab experiments (4 hours)

Flow around a cylinder experiment Introduction (1 hour)

Flow around a cylinder experiment Operation (3 hours)

Week 5 Hands-on practice of lab experiments (4 hours)

Drag forces on bluff and streamlined bodies experiment Introduction (1 hour)

Drag forces on bluff and streamlined bodies experiment Operation (3 hours)

Week 6 Hands-on practice of lab experiments (4 hours)

Flow and pressure distribution, lift and drag forces on an aerofoil measurement Introduction (1 hour)

Flow and pressure distribution, lift and drag forces on an aerofoil measurement Operation (3 hours)

Week 7 Hands-on practice of lab experiments (4 hours)

Boundary layer measurement experiment Introduction (1 hour)

Boundary layer measurement experiment Operation (3 hours)

Week 8 Operation demonstration lab experiments (4 hours)

Hot-wire anemometer and PIV experiment Introduction (1 hour)

Boundary layer measurement experiment Operation demonstration (3 hours)

Week 9 Hands-on practice of lab experiments (4 hours)

Measurement of thermal conductivity Introduction (1 hour)

Measurement of thermal conductivity Operation (3 hours)

Week 10 Hands-on practice of lab experiments (4 hours)

Experiments on convective heat transfer Introduction (1 hour)

Experiments on convective heat transfer Operation (3 hours)

Week 11 Hands-on practice of lab experiments (4 hours)

Experiments on radiant heat transfer Introduction (1 hour)

Experiments on radiant heat transfer Operation (3 hours)

Week 12 Hands-on practice of lab experiments (4 hours)

Experiments on heat exchange with heat pipe Introduction (1 hour)

Experiments on heat exchange with heat pipe Operation (3 hours)

Week 13 Demonstration experiments and group design project (4 hours)

Demonstration on flow, flame test and so on (2 hours)

Group design project discussion (2 hours)

Week 14-15 Group design project (8 hours)

Design and fabrication based on the project goal (4 hours x 2)

Group design project discussion (3 hours)

Week 16 Group design project (4 hours)

Oral presentation (4 hours)

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

- 闻建龙,《流体力学实验》, 江苏大学出版社出版, 2010
- Wind Tunnel Instruction Manual, Armfield Ltd, 2015
- 刘晓华, 刘宏升, 刘红, 《热工基础实验教程》, 大连理工大学出版社出版, 2012
- 郭美荣, 俞爱辉, 高婷, 《热工实验》, 冶金工业出版社, 2015

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		5		实验操作与完成情况和团队项目表现 (evaluate on experimental

Performance				operation and completion along with project performance)
小测验 Quiz				
课程项目 Projects		20		项目开题 Project proposal 5% 项目报告 Project report 15%
平时作业 Assignments		70		实验报告 Lab reports 7% x 10
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation	4	5		(小组分数 Group mark)
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**

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|--------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> A. 十三级等级制 Letter Grading
<input type="checkbox"/> B. 二级记分制 (通过/不通过) Pass/Fail Grading |
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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

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