

## 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<br><b>Course Title</b>  | 航空飞行器动力学 <b>Aircraft Flight Dynamics</b>  |                              |                               |  |
| 2.  | 授课院系<br><b>Originating Department</b>  | 力学与航空航天工程系 Department of Mechanics and Aerospace Engineering  |                              |                               |  |
| 3.  | 课程编号<br><b>Course Code</b>   | MAE312  |                              |                               |  |
| 4.  | 课程学分<br><b>Credit Value</b>  | 3   |                              |                               |  |
| 5.  | 课程类别<br><b>Course Type</b>   | 专业选修课 Major Elective Courses  |                              |                               |  |
| 6.  | 授课学期<br><b>Semester</b>  | 秋季 Fall   |                              |                               |  |
| 7.  | 授课语言<br><b>Teaching Language</b>   | 英文 English  |                              |                               |  |
| 8.  | 授课教师、所属学系、联系方式<br>(如属团队授课, 请列明其他授课教师)<br><b>Instructor(s), Affiliation &amp; Contact</b><br>(For team teaching, please list all instructors) | 王浩 研究助理教授<br>力学与航空航天工程系<br>wangh7@sustech.edu.cn<br>Wang Hao Research Assistant Professor<br>Department of Mechanics and Aerospace Engineering<br>wangh7@sustech.edu.cn |                              |                               |  |
| 9.  | 实验员/助教、所属学系、联系方式<br><b>Tutor/TA(s), Contact</b>  | 待公布 To be announced   |                              |                               |  |
| 10. | 选课人数限额(可不填)<br><b>Maximum Enrolment (Optional)</b>   |   |                              |                               |  |
| 11. | 授课方式<br><b>Delivery Method</b>   | 讲授<br><b>Lectures</b>   | 习题/辅导/讨论<br><b>Tutorials</b> | 实验/实习<br><b>Lab/Practical</b> | 其它(请具体注明)<br><b>Other (Please specify)</b> |
|     | 学时数<br><b>Credit Hours</b>   | 48  |                              |                               | 48   |

|  |  |
|--|--|
| 12. 先修课程、其它学习要求<br><b>Pre-requisites or Other Academic Requirements</b>    | 高等数学（下）A 或者 数学分析 II 或者 高等数学（下）<br>Calculus II A or Mathematical Analysis II or Calculus II |
| 13. 后续课程、其它学习规划<br><b>Courses for which this course is a pre-requisite</b> | 无 NA   |
| 14. 其它要求修读本课程的学系<br><b>Cross-listing Dept.</b>                             | 无 NA   |

### 教学大纲及教学日历 SYLLABUS

#### 15. 教学目标 Course Objectives

航空器飞行动力学是航空航天系本科生的专业选修课。它在培养学生掌握飞行性能，飞行器平衡稳定性以及飞行控制方面的分析和设计能力，以及在飞行器总体设计占据重要地位。

此课程将采用理清概念，理论分析，数值计算以及紧密联系现有无人机项目的方式实现课程目标。

航空器飞行动力学基本内容包括飞行性能，飞行器平衡稳定性以及飞行控制。

Aircraft flight dynamics is a major elective course for undergraduates in aerospace engineering. This course is important for students in the aspects of understanding flight performance, stability, flight control and design.

In this course, theory, concepts and practice will be closely related to achieve course objectives. The basic contents include aircraft flight performance analysis, equilibrium and stability, and feedback flight control.

#### 16. 预达学习成果 Learning Outcomes

航空飞行动力学在飞行器性能分析和设计方面有着重要应用。通过此课程，学生能够全面掌握航空器飞行性能的分析与计算方法，线性与非线性飞行器平衡稳定性的分析方法，以及了解飞行器主动控制的基本原理，能够在现有的开源飞控的基础上，编纂自定义的飞控代码。这对于后续的飞行器整体设计具有重要意义。

Aircraft flight dynamics has practical application in aircraft flight performance analysis and design. After this course, students are expected to fully understand the methodology of analyzing the flight performance of a given aircraft. The second part is to know how to employ linear and non-linear flight stability analysis approaches in aircraft design. Students are also expected to gain the skills of writing basic flight control codes. These outcomes will be further implemented in the aircraft design course.

#### 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.)**

|            |  |
|------------|--|
| Section 1  | Introduction on aircraft flight dynamics (3 credit hours)                              |
| Section 2  | Basic aircraft aerodynamics and propulsion characteristics (3 credit hours)            |
| Section 3  | Take-off and landing flight performance + Tutorial 1 (3 credit hours)                  |
| Section 4  | Climbing, gliding and turning flight performance (3 credit hours)                      |
| Section 5  | Cruise flight performance -1 (3 credit hours)  |
| Section 6  | Cruise flight performance -2 + Tutorial 2 (3 credit hours)                             |
| Section 7  | General equations of motion for Rigid body dynamics and linearization (3 credit hours) |
| Section 8  | Static stability and control devices-1 (3 credit hours)                                |
| Section 9  | Static stability and control devices-2 + Tutorial 3 (3 credit hours)                   |
| Section 10 | Linear stability analysis in longitudinal motion (3 credit hours)                      |
| Section 11 | Linear stability analysis in lateral-directional motion (3 credit hours)               |
| Section 12 | Nonlinear flight dynamic + Tutorial 4 (3 credit hours)                                 |
| Section 13 | Introduction of basic feedback control and PID controller (3 credit hours)             |
| Section 14 | Basic flight control design (3 credit hours)   |
| Section 15 | More complicated topics in aircraft flight dynamics + Tutorial 5 (3 credit hours)      |
| Section 16 | Revision and Final Exam (3 credit hours)   |

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

|       |   |
|-------|---|
| 教材:   |   |
| 1.    | Anderson, J. (1999). Aircraft performance and design, McGraw-Hill.                                  |
| 2.    | Nelson, R. C. (1998). Flight stability and automatic control, WCB/McGraw Hill.                      |
| 参考书目: |   |
| 1.    | Anderson, J. (2010). Fundamentals of Aerodynamics, McGraw-Hill.                                     |
| 2.    | R. F. Stengel, Flight Dynamics, Princeton University Press, 2004.                                   |
| 3.    | Etkin, B. and L. D. Reid (1995). Dynamics of Flight: Stability and Control, Wiley.                  |
| 4.    | Wang, H (2016). Aerodynamics, Flight dynamics and Design of Wing-In-Ground (WIG) craft, Phd Thesis. |

课程评估 ASSESSMENT

| 19. 评估形式<br>Type of<br>Assessment | 评估时间<br>Time | 占考试总成绩百分比<br>% of final<br>score | 违纪处罚<br>Penalty | 备注<br>Notes |
|-----------------------------------|--------------|----------------------------------|-----------------|-------------|
| 出勤 Attendance                     |              |                                  |                 |             |

|   |    |                             |  |
|---|----|-----------------------------|--|
| 课堂表现<br><b>Class Performance</b>  |    |                             |  |
| 小测验<br><b>Quiz</b>  | 20 |                             |  |
| 课程项目<br><b>Projects</b>   | 50 | 抄袭本项记 0 分<br>Cheating:0     |  |
| 平时作业<br><b>Assignments</b>  |    |                             |  |
| 期中考试<br><b>Mid-Term Test</b>  |    |                             |  |
| 期末考试<br><b>Final Exam</b>   | 30 | 考试作弊本门课程记 0 分<br>Cheating:0 |  |
| 期末报告<br><b>Final Presentation</b>   |    |                             |  |
| 其它（可根据需要<br>改写以上评估方式）<br><b>Others (The above may be modified as necessary)</b> |    |                             |  |

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