

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	喷气推进 Jet Propulsion
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	MAE407
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业核心课 Major Core Course (航空航天工程 Aerospace Engineering) 专业选修课 Major Elective Course (理论与应用力学 Theoretical & Applied Mechanics)
6.	授课学期 Semester	春季 Spring
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)	刘宇 副教授 力学与航空航天工程系 liuy@sustech.edu.cn LIU Yu Associate Professor Department of Mechanics and Aerospace Engineering liuy@sustech.edu.cn
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	MAE305 工程热力学 或 PHY204 热力学与统计物理 I Engineering Thermodynamics / Thermodynamics and Statistical Physics I				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 NA				
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 NA				

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程主要讲述喷气推进技术的主要原理，航空发动机的基本结构和主要设计方法。

课程的主要教学目标为：

- 了解目前大型民用飞机选择航空发动机的主要准则和设计要求；
- 介绍现代民用航空发动机的空气动力学与热力学设计的相关知识，包括飞行器空气动力学、工程热力学、可压缩流动、燃气轮机循环、推力产生以及涵道比选择、等等；
- 熟悉航空发动机的各部件特性，包括基本构成、主要作用以及基本技术参数；
- 理解如何对航空发动机的非设计点工况进行匹配。

The aims of the course are to:

- Understand why current engines on large airliners look as they do, how they work and how they are specified;
- Determine what is needed to propel a new large airliner;
- Appreciate the mixture of physical modelling and empirical input necessary to make the decisions to allow a design to proceed, as well as the need for compromises.

16. 预达学习成果 Learning Outcomes

- 顺利完成本课程学习后，学生们将：
- 建立对基于喷气推进技术的航空发动机的系统构成、原理及设计方法的基本认识；
- 培养和增强如何在复杂工程问题中运用各种基础知识和方法的能力；
- 具备为不同飞行器选择动力系统、并为新的飞行器动力装置设计主要技术参数的能力。
- By the end of the course students should be able to:
- Calculate the major parameters of the engine (this will be carried out in the form of exercise questions throughout the course);
- Make appropriate design choices for engine components;
- Sketch a cross-section of the engine showing principal components with appropriate parameters;

- Calculate the effect of speed and altitude on engine performance.

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. 航空喷气推进发展简史（1 课时）
 2. 航空燃气轮机概论（2 课时）
 3. 大型民机设计要求和背景（2 课时）
 4. 飞行器空气动力学简介（3.5 课时）
 5. 喷气发动机的推力产生（1.5 课时）
 6. 燃气轮机的循环（4 课时）
 7. 喷气发动机原理与构成（3 课时）
 8. 可压缩流体力学基础（4 课时）
 9. 期中考试（2 课时）
 10. 涵道比的选择（5 课时）
 11. 动态比例调节与无量纲分析（3.5 课时）
 12. 涡轮机械：压气机与涡轮（4.5 课时）
 13. 民机发动机设计总览（0.5 课时）
 14. 发动机的部件特性（5.5 课时）
 15. 发动机非设计点工况匹配（6 课时）
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1. A brief history of jet propulsion (1 credit hour)
 2. Introduction to aircraft gas turbines (2 credit hours)
 3. The new large aircraft – requirements and background (2 credit hours)
 4. The aerodynamics of the aircraft (3.5 credit hours)
 5. The creation of thrust in a jet engine (1.5 credit hours)
 6. The gas turbine cycle (4 credit hours)
 7. The principle and layout of jet engines (3 credit hours)
 8. Elementary fluid mechanics of compressible gases (4 credit hours)

9. Mid-term exam (2 credit hours)
10. Selection of bypass ratio (5 credit hours)
11. Dynamic scaling and dimensional analysis (3.5 credit hours)
12. Turbomachinery: compressors and turbines (4.5 credit hours)
13. Overview of the civil engine design (0.5 credit hour)
14. Engine component characteristics (5.5 credit hours)
15. Engine matching off-design (6 credit hours)

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

教材 Textbook:

[1] N.A. Cumpsty, "Jet Propulsion: A Simple Guide to the Aerodynamic and Thermodynamic Design and Performance of Jet Engines", Cambridge University Press, 2nd edition, 2003 (The basis of the course content with additional material).

参考书目 Supplementary Readings:

- [2] P.G. Hill and C.R. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison-Wesley, 2nd edition, 1992 (A very good introduction).
- [3] Rolls-Royce, "The Jet Engine", 5th edition, Rolls Royce, 2005 (Excellent practical background with some great pictures).
- [4] H.I.H. Saravanamutto, G.F.C. Rogers, H. Cohen, P.V. Straznicky and A.C. Nix, "Gas Turbine Theory", Pearson, 7th edition, 2017 (Details on jet engine turbomachinery).

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 Performance		5		
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		20	抄袭平时作业记	

			0分 Cheating:0	
期中考试 Mid-Term Test	2 小时 2 hours	25	考试作弊本门课程记 0 分 Cheating:0	
期末考试 Final Exam	2 小时 2 hours	50	考试作弊本门课程记 0 分 Cheating:0	
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

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

