

## 课程大纲 COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	MAE5017/航空声学与气动噪声 Aeroacoustics
2.	课程性质 Compulsory/Elective	专业选修课 Major Elective Courses
3.	课程学分/学时 Course Credit/Hours	3 credit / 48 hours
4.	授课语言 Teaching Language	英文 English
5.	授课教师 Instructor(s)	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
6.	是否面向本科生开放 Open undergraduates or not	是 Yes
7.	先修要求 Pre-requisites	MAE303 流体力学 或者 MAE207 工程流体力学 Fluid Mechanics OR Engineering Fluid Mechanics
8.	<b>教学目标 Course Objectives</b>	
	<p>The students are expected to analyse and solve a range of practical engineering problems associated with aeroacoustics. Examples include modelling of noise sources from jets, fans, wind turbines, etc. and exploring ways to reduce noise either at the source or through acoustic damping. Upon completion of this module, students would be well placed to pursue research in the area of aeroacoustics and related fields, and should understand</p> <ul style="list-style-type: none"> <li>• how sound is generated,</li> <li>• how sound propagates in free space and within ducts,</li> <li>• and be able to model sound sources for various aeroacoustic problems and design for low noise.</li> </ul>	
9.	<b>教学方法 Teaching Methods</b>	
	Lectures 40 hours, Tutorials 8 hours	
10.	<b>教学内容 Course Contents</b>	
	<b>Section 1</b>	<b>Characteristics of Sound (4.5 credit hours)</b> 1.1 Introduction (1 credit hour) 1.2 The 1D wave equation (1 credit hour) 1.3 Energy of 1D acoustic waves (1 credit hour) 1.4 Sound spectra (1.5 credit hours)
	<b>Section 2</b>	<b>Three-Dimensional Sound Waves (8 credit hours)</b> 2.1 The 3D wave equation (1 credit hour) 2.2 Energy of 3D acoustic waves (1 credit hour) 2.3 3D plane wave field (1 credit hour) 2.4 Spherical wave field (1.5 credit hours) 2.5 Simple sound sources (3.5 credit hours)

<b>Section 3</b>	<b>Waves in Pipes and Resonators (6 credit hours)</b> 3.1 Plane waves (1 credit hour) 3.2 Higher order modes (2 credit hours) 3.3 Pipes of varying cross-section (0.5 credit hour) 3.4 Organ pipes (1 credit hour) 3.5 The Rijke tube (0.5 credit hour) 3.6 The Helmholtz resonator (1 credit hour)
<b>Section 4</b>	<b>Sound Waves at Interfaces (4 credit hours)</b> 4.1 Waves incident on a flexible surface (1.5 credit hours) 4.2 Sound propagation through vibrating walls (0.5 credit hour) 4.3 Sound refraction at interfaces of fluid discontinuity (1 credit hour) 4.4 Evanescent waves (1 credit hour)
<b>Section 5</b>	<b>Ray Theory (3.5 credit hours)</b> 5.1 The ray theory equations (1.5 credit hours) 5.2 Underwater sound propagation (0.5 credit hour) 5.3 Sound propagation in the atmosphere (1.5 credit hours)
<b>Section 6</b>	<b>Sources of Sound (16.5 credit hours)</b> 6.1 The definition of a sound source (1 credit hour) 6.2 The monopole source (2 credit hours) 6.3 The dipole source (2 credit hours) 6.4 Acoustic source processes (2.5 credit hours) 6.5 Sound generation by flow – Lighthill's acoustic analogy (2.5 credit hours) 6.6 The sound of foreign bodies (1 credit hour) 6.7 The effect of foreign bodies in linear motion (5.5 credit hours)
<b>Section 7</b>	<b>Sound Generated near Surfaces of Discontinuity (5.5 credit hours)</b> 7.1 Reciprocity of source and field (1 credit hour) 7.2 Sound sources near a plane surface of discontinuity (2.5 credit hours) Kirchhoff's theorem for plane surfaces (2 credit hours)
<b>11. 课程考核 Course Assessment</b>	
1. 考试 exam  2. 课堂表现 Class Performance 10% 平时作业 Assignments 40% 期末考试 Final Exam 50%  3. There is no difference between undergraduate and graduate students.	
<b>12. 教材及其它参考资料 Textbook and Supplementary Readings</b>	
1. A.P. Dowling and J.E. Ffowcs Williams, Sound and Sources of Sound, Ellis Horward Ltd., Chichester, UK, 1983 2. 戈德斯坦 (闫再友译), 气动声学, 国防工业出版社, 2014 3. 张强, 气动声学基础, 国防工业出版社, 2012	