课程大纲
COURSE SYLLABUS

1.	课程代码/名称 **Course Code/Title**	**MAE5007 高等计算固体力学** **Advanced Computational Solid Mechanics**
2.	课程性质 **Compulsory/Elective**	专业核心课 Graduate core course
3.	课程学分/学时 **Course Credit/Hours**	3/48
4.	授课语言 **Teaching Language**	英文 English
5.	授课教师 **Instructor(s)**	刘巨 助理教授 力学与航空航天工程系 liuj36@sustech.edu.cn LIU Ju, Assistant Professor Department of Mechanics and Aerospace Engineering liuj36@sustech.edu.cn
6.	是否面向本科生开放 **Open to undergraduates or not**	是 YES
7.	先修要求 **Pre-requisites**	（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.） MAE202 材料力学 Mechanics of Materials

8. 教学目标
Course Objectives

本课程将为学生重点讲授有限元法的基本原理和在结构应力及振动分析中的应用：包括 1D/2D/3D 单元构建、方程组装求解、计算机编程、商用软件实际操作、和实际工程问题建模求解技巧。

This course will provide students with a solid foundation of the finite element method, and skills in its software development and applications in solving practical problems in structural stress and dynamics analyses. Students will have the grasp of the 1D/2D/3D element formulations, assembly of the equations and their solution methods, skills in computer programing as well as in use of commercial software packages, and techniques in modeling and simulation of practical engineering problems using the FEM.

9. 教学方法
Teaching Methods

讲授 **Lectures**

10. 教学内容
Course Contents

Section 1	Introduction of the FEM and its applications in engineering (2 credit hours)

Section 2	A model one-dimensional boundary value problem (4 credit hours)
Section 3	Galerkin formulation and finite element discretization (2 credit hours)
Section 4	Local and global versions of the FEM, Gauss quadrature, stiffness matrix, and data structures for programming (4 credit hours)
Section 5	A priori error estimate, best approximation property, and convergence analysis (2 credit hours)
Section 6	Accuracy of the derivatives; flux recovery; higher-order elements (4 credit hours)
Section 7	Review of the small-strain elastostatics (2 credit hours)
Section 8	Generic element arrays; Voigt notation, assembly of the stiffness matrix (4 credit hours)
Section 9	Isoparametric elements; higher-order elements; isogeometric analysis (2 credit hours)
Section 10	Plane stress and plane strain problems (4 credit hours)
Section 11	Incompressible elasticity; locking phenomenon; mixed finite element method (2 credit hours)
Section 12	Review of small-strain elastodynamics; semi-discrete formulation; Rayleigh damping matrix (4 credit hours)
Section 13	Modal reduction; time-stepping procedures (2 credit hours)
Section 14	Spectral stability; convergence analysis of one-step methods (4 credit hours)
Section 15	Numerical dissipation and dispersion; generalized-**α** method (2 credit hours)
Section 16	Review of small-strain nonlinear elastostatics and the Newton-Raphson method (4 credit hours)

11. 课程考核
Course Assessment

（①考核形式 Form of examination；②.分数构成 grading policy；③如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

1.no final exam

2. 课程项目 **Projects 15%**
平时作业 **Assignments 15%**
期中考试 Midterm exam 30%
期末报告 **Final Presentation 40%**

	3. There is no difference between undergraduate and graduate students.
12.	教材及其它参考资料 **Textbook and Supplementary Readings**
	1. The Finite Element Method: linear static and dynamic finite element analysis, Thomas J.R. Hughes, Dover 2000. 2. Finite elements: an introduction, Eric B. Becker, Graham F. Carey, and J. Tinsley Oden, 1981. 3. The Finite Element Method: Its Basis and Fundamentals, by O. C. Zienkiewicz, R. L. Taylor, and J.Z. Zhu, 6th edition, Elsevier, 2005 (PDF copy). 4. 有限单元法，王勖成编著，清华大学出版社，2003. Finite Element Modeling and Simulation with ANSYS Workbench, by Xiaolin Chen and Yijun Liu, CRC Press, 2014 (PDF Lecture slides).