# 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.

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|---|---|---|
| 1. | **课程名称 Course Title** | 动力学与机械振动<br>Dynamics and Vibration |
| 2. | **授课院系**<br>**Originating Department** | 机械与能源工程系<br>Department of Mechanical and Energy Engineering |
| 3. | **课程编号**<br>**Course Code** | ME301-16 |
| 4. | **课程学分 Credit Value** | 2 |
| 5. | **课程类别**<br>**Course Type** | 专业基础课<br>Major Foundational Course |
| 6. | **授课学期**<br>**Semester** | 秋季学期<br>Fall |
| 7. | **授课语言**<br>**Teaching Language** | 英文<br>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）**<br>**Instructor(s), Affiliation& Contact**<br>**（For team teaching, please list all instructors）** | 郑裕基<br>机械与能源工程系<br>zhengyj@sustc.edu.cn<br><br>U Kei Cheang<br>Department of Mechanical and Energy Engineering |
| 9. | **实验员/助教、所属学系、联系方式**<br>**Tutor/TA(s), Contact** | 待公布 To be announced |
| 10. | **选课人数限额(可不填)**<br>**Maximum Enrolment（Optional）** | |

| 11. | | **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** |
|---|---|---|---|---|---|---|
| | **授课方式**<br>**Delivery Method** | | | | | |
| | **学时数**<br>**Credit Hours** | 24 | 0 | 16 | 0 | 40 |

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|---|---|---|
| 12. | 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements | MAE203B 理论力学 I -B Engineering Mechanics I - Statics and Dynamics<br>MA201b 常微分方程 B Ordinary Differential Equation B |
| 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**

This course provides students with necessary background of dynamics of particles, dynamics of rigid bodies, and dynamics of flexible bodies (vibration). Students will learn how to describe motion in different coordinate systems (kinematics) and how to develop the relationship between the forces applied on the system and the motion caused (kinetics). The approaches of differential equations, principle of work and energy, and principles of linear and angular impulse and moment are introduced to solve dynamic problems in different disciplines. Analysis for both free vibration and forced vibration for linear single degree-of-freedom (SDOF), multiple degree-of-freedom (MDOF), and continuous systems are discussed.

16. **预达学习成果 Learning Outcomes**

After completing this course, the students should learn the basic concepts and principles of dynamics and vibration, develop problem-solving skills for applications in different engineering disciplines, and provide sound background for more advanced studies.

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.)**

| **Kinematics and Kinetics of Particles** | Hours |
|---|---|
| • Fundamentals of Dynamics | 0.5 |
| • Rectilinear Continuous Motion | 1 |
| • Rectilinear Motion with Constant Acceleration | 0.5 |
| • Rectilinear Erratic Motion | 1 |
| • Curvilinear Motion_ Rectangular Components | 0.5 |
| • Motion of a Projectile | 0.5 |
| • Curvilinear Motion Normal and Tangential Components, Cylindrical Components | 1.5 |
| • Absolute Dependent Motion Analysis | 0.5 |
| • Relative Motion of Two Particles | 0.5 |
| • Equations of Motion Rectangular Coordinates, Normal and Tangential Coordinates, Cylindrical Coordinates | 1.5 |
| • The Work of a Force | 0.5 |
| • Principle of Work and Energy | 0.5 |
| • Power and Efficiency | 0.5 |
| • Conservation of Energy | 0.5 |
| • Principle of Linear Impulse and Momentum | 0.5 |
| • Conservation of Linear Momentum for a System of Particles | 0.5 |
| • Impact and the Coefficient of Restitution | 0.5 |
| • Angular Impulse and Momentum | 0.5 |
| **Kinematics and Kinetics of Rigid Bodies** | |
| • Rigid Body Planar Motion. Translation | 0.5 |
| • Rotation about a Fixed Axis | 1 |
| • General Plane Motion: Relative Motion Analysis, Instantaneous Center of Zero Velocity, and Absolute Motion Analysis | 1.5 |
| • Relative Motion Analysis Using Rotating Axes | 1 |
| • Mass Moment of Inertia | 1 |
| • Equations of Motion for Planar Motion: Translation and Rotation | 1.5 |
| • Equations of motion for planar motion: General plane motion | 0.5 |
| • Work and Energy for Rigid Body Planar Motion | 1 |
| • Impulse and Momentum for Rigid Body Planar Motion | 1 |
| **Vibration** | |
| • Vibration of SDOF Systems | 1 |
| • Vibration of MDOF Systems | 1 |
| • Vibration of Continuous Systems | 1 |
| **Laboratory sessions** | |
| • Dynamic modelling using MATLAB | 6 |
| • Dynamic modelling using ADAMS | 5 |
| • Dynamic modelling using LabVIEW | 5 |
| **Examinations** | |
| • Midterm Exam (Week 9) | |
| • Final Exam (Week 17 or 18) | |



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

R.C. Hibbeler: Dynamics, 14th edition, Pearson Prentice Hall, 2016.

S.S. Rao: Mechanical Vibrations. 5th Edition, Pearson Prentice Hall, 2011.

## 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 | | 10% | | |
| 课堂表现 Class | | | | |

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|---|---|---|---|---|
| **Performance** | | | | |
| **小测验 Quiz** | | 20% | | |
| **课程项目 Projects** | | | | |
| **平时作业 Assignments** | | 10% | | |
| **期中考试 Mid-Term Test** | | 30% | | |
| **期末考试 Final Exam** | | 30% | | |
| **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**

机械与能源工程系教学委员会