

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	创新设计理论与实践 Innovative Design Theory and Practice				
2.	授课院系 Originating Department	机械与能源工程系 Department of Mechanical and Energy Engineering				
3.	课程编号 Course Code	ME405				
4.	课程学分 Credit Value	3				
5.	课程类别 Course Type	专业核心课 Major Core Courses				
6.	授课学期 Semester	秋季 Fall				
7.	授课语言 Teaching Language	中英双语 English & Chinese				
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)	苏海军 Su Haijun 1289497161@qq.com				
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	待公布 To be announced				
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	32		32		64

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	ME303 机械设计基础 Fundamentals of Machine Design ME305 创新设计实践 Innovative Design Practice
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.	机械工程 Mechanical Engineering

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程是机电类专业课程的高级课程。在回顾学过的机电理论知识的同时，结合创新设计理论，同步开展机电产品创新实践项目。为学生提供一个在学习基本机电产品创新设计方法与工具的同时动手参加一个机电实训项目制作与竞赛全过程的教学平台，达到训练学生工程创新决策与思维能力目的，同时也能对学生的动手能力、设计能力和团体合作能力进行训练，为毕业设计以及今后工作打下良好基础。通过本课程学习，学生能够：学习到解决工程问题的基本方法；学会用灵活实用和创造性手段分析、综合与实现工程解决方案的方法和工具；学会如何处理遇到的工程中的新问题与挑战；学会如何开展团队合作完成目标任务。

This course is a prerequisite course in mechanical and electrical specialties. By class theory learning and synchronized with the practice of projects, provide a basic learning method, innovation in the field of machinery and electrical equipment, at the same time, it participated in the production and competition of a mechanical and electrical training project in the whole process, provide a teaching platform for students, training students' ability of engineering innovation and thinking, also pay attention to students' practical ability, design ability and team cooperation ability, points out the direction for the study of the following courses and lay a good foundation for future work. By learning this course, students can learn the basic methods to solve engineering problems; to analyze, methods and tools of project and implementation of integrated solutions for flexible and practical and creative means; learn how to deal with new problems and challenges encountered in engineering; learn how to work together as a team to accomplish a task.

16. 预达学习成果 Learning Outcomes

- 1、掌握工程项目调研基本工具（需求调查表与产品质量图、功能树、技术参数表），并能初步用于实践项目的实现；
 - 2、初步学会工程项目开发基本流程与方法并用于实践项目实现。
 - 3、学习巩固机械设计、自动控制学习的内容，初步掌握机电一体化化的设计方法与技能，包括产品的总体设计规划、传感、人机交互接口、信号分析、反馈控制等。
 - 4、以安卓手机+Arduino 卡为软硬件基础，动手实践，完成一个自定义简单机电一体化产品的创意和设计实现。
 - 5、以 Modelica 多领域物理系统建模平台为基础，了解复杂机电产品方案设计阶段的数字设计和仿真方法。
 - 6、学会通过团队合作与沟通完成工程项目开发的基本技巧与沟通工具（组织研发团队、团队内部交流与沟通）。
 - 7、初步理解如何高效编制技术文档（调研报告、技术报告、总结报告、技术报告编写中的诚信问题）。
- 1、Master the basic tools of engineering project investigation (chapter1/2/3 Requirement questionnaire、Product quality chart、Function tree and Technical parameter list), and can be used for the realization of practical project;
 - 2、Learn the basic process and method of engineering project development, and apply it to practice project realization (chapter4/5/6/7 Product concept design、Safety analysis、Project implementation plan).
 - 3、Learning to consolidate the contents of mechanical design and automatic control, Master the design methods and skills of Mechatronics, including the overall design, planning, sensing, human-computer interaction interface, signal analysis and feedback control.
 - 4、Learn to work through teamwork and communication to complete the basic skills of project development and communication tools (chapter8/9 Organization, R & D team、Communication and communication within the team).
 - 5、Initial understanding of how to prepare technical documents efficiently (chapter10/11/12 Research reports、Technical reports, Summary reports and Integrity problems in compiling technical report).

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.)

授课学时为 32 学时，课堂实验+展示与报告 32 学时	
第一章：机电创新设计简介	1 学时
Chapter 1: Brief introduction of mechanical and electrical innovation design	
第二章：典型机电产品及其构成	
Chapter2: Typical mechanical and electrical products and their composition	
1. 典型机电产品介绍	1 学时
Introduction of typical mechanical and electrical products	
2. 常用嵌入式系统控制器介绍	2 学时
Introduction of common embedded system controller	
3. 常用传感器介绍	2 学时
Introduction of common sensors	
4. 常用执行器介绍	2 学时
Introduction of commonly used actuators	
5. 机电产品中的数字信号处理技术	4 学时
Digital signal processing technology in mechanical and electrical products	
课堂课堂实验+展示与报告环节：	
Classroom experiment + show and report link:	
1. 安卓手机编程入门	10 学时
Android mobile programming	
2. Arduino 卡编程入门	6 学时
Introduction to Arduino card programming	
3. 学生汇报：淘宝上的测控卡、微电机、气泵、传感器等机电零件资源	2 学时
Student report: Taobao's measurement and control card, micro motor, air pump, sensor and other mechanical and electrical parts resources	
：机电产品创新设计理论	4 学时
Innovative design theory of mechanical and electrical products	
五种主要的产品创新类型	
Five main types of product innovation	
产品创新设计的 8 个阶段	
8 stages of product innovation design	
课堂课堂实验+展示与报告环节：	
Classroom experiment + show and report link:	
1. 学生汇报与研讨：拟制作的小型机电产品构思	2 学时
Student report and discussion: the idea of small mechanical and electrical products to be produced	
第四章：机电产品设计、规划工具	4 学时
Mechanical and electrical product design and planning tools	
1. Tree diagram	
Gantt Chart	
Prioritization matrix	
Job Responsibilities Matrix	
课堂课堂实验+展示与报告环节：	
Classroom experiment + show and report link:	
1. 学生汇报与研讨：拟制作的小型机电产品规划	2 学时
Student report and discussion: Planning of small mechanical and electrical products	
第五章：机电产品多领域建模与仿真	6 学时
Multi domain modeling and Simulation of mechanical and electrical products	
几种主要的单领域建模与仿真工具介绍(ANSYS, ADAMA ,Multisim, SIMULINK)	
Introduction of several main single domain modeling and simulation tools(ANSYS, ADAMA ,Multisim, SIMULINK)	
Modlica 多领域建模与仿真工具	
Modlica multi domain modeling and simulation tools	
课堂课堂实验+展示与报告环节： Classroom experiment + show and report link:	
1. 学生机电产品数字设计实验：六自由度机械手设计	6 学时
Student mechanical and electrical products digital design experiment: six degree of freedom manipulator design	
第六章：机电产品设计案例解析	4 学时
Case analysis of mechanical and electrical product design	
两轮平衡电动车	
Two wheel balanced electric vehicle	
大学生机电产品创新设计大赛作品	
Innovative design contest of mechanical and electrical products for College Students	
第六章：项目汇报	2 学时
Project Report	
如何写作项目工作报告	
How to write project work report	

如何准备项目汇报 PPT 文档
How to prepare project report PPT document
课堂课堂实验+展示与报告环节:
Classroom experiment + show and report link:
1.学生完成的机电产品展示与答辩
Students' mechanical and electrical products display and defense
合计: 授课 32 学时, 实验 32 学时
Total: 32 hours of teaching, 32 hours of experiment

4 学时

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

教材: William Singhose 主编. Introductory Mechantronics Design Tools(中英双语版). 武汉: 华中科技大学出版社, 2012
《Android 应用开发基础》
[美] 约翰·白赫泰 (John Baichtal), Arduino 从入门到精通, 机械工业出版社
网络文献, 两轮平衡车工作原理

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				
小测验 Quiz				
课程项目 Projects		40%		实践项目制作与竞赛, 占总成绩 40%
平时作业 Assignments		40%		课堂展示与报告四次, 一次占总成绩 10%, 共 40%
期中考试 Mid-Term Test				
期末考试 Final Exam				
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%		实践项目技术汇报与交流，占总成绩20%

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

