南方科技大学 SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

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**	控制工程基础 Fundamentals of Control Engineering
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**	ME307
4.	**课程学分 Credit Value**	3
5.	**课程类别** **Course Type**	专业基础课 Major Foundational Courses
6.	**授课学期** **Semester**	春季 Spring / 秋季 Fall
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）**	杨再跃 机械与能源工程系 Department of Mechanical and Energy Engineering yangzy3@sustech.edu.cn 郑裕基 机械与能源工程系 Department of Mechanical and Energy Engineering zhengyj@sustech.edu.cn
9.	**实验员/助教、所属学系、联系方式** **Tutor/TA(s), Contact**	黄业绪 机械与能源工程系 Department of Mechanical and Energy Engineering huangyx3@sustech.edu.cn
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	40		24		64

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	EE104 电路基础 Fundamentals of Electric Circuits 建议修读 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	ME306 机器人基础 Fundamentals of Robotics ME401 信号分析 Signal Analysis
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

无论在工程应用还是在科学研究领域，自动控制都是必不可少的。自动控制在空间飞行器系统、机器人系统、现代制造系统及有关温度、压力、湿度、流量等控制的工业操作系统中占着重要的组成部分。大多数工程师和科学家都熟悉自动控制的理论和实践。今天常用的控制理论包括：经典控制理论(也称传统控制理论)、现代控制理论和鲁棒控制理论。本课程以经典控制理论为基础，来对控制系统进行分析与设计并进行综合处理。通过该课程的学习，为学生提供处理控制工程问题的一般方法，包括建模、分析和控制系统的设计；介绍如何用一组微分方程、传递函数和相应的框图来表示控制系统；讨论如何在时域、频域、s域等方面对受控系统的性能进行评估，使学生掌握如何采取适当的控制措施来提高系统的性能。

Automatic control is essential in any field of engineering and science. Automatic control is an important and integral part of space-vehicle systems, robotic systems, modern manufacturing systems, and any industrial operations involving control of temperature, pressure, humidity, flow, etc. It is desirable that most engineers and scientists are familiar with theory and practice of automatic control. Control theories commonly used today are classical control theory (also called conventional control theory), modern control theory, and robust control theory. This course presents comprehensive treatments of the analysis and design of control systems based on the classical control theory. It provides students a general method in control engineering including modeling, analysis, and design of control systems. It illustrates how to represent a control system by a set of differential equation, transfer function, and the corresponding block diagram. The course discusses how to evaluate performance of a controlled system in the time domain, the frequency domain, the s-domain, how to take appropriate control actions to improve the system performance.

16. 预达学习成果 Learning Outcomes

完成本课程的学习后，学生应该掌握控制工程的基本概念和原理，了解并提高解决不同工程学科实际控制问题的技能，为后期课程的学习提供必要的背景知识。

After completing this course, the students should know well the basic concepts and principles of control engineering, develop problem-solving skills for applications in different engineering disciplines, and provide essential 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.)

课程内容(学时)Course Contents(Credit Hours)

第一章　控制系统介绍
Chapter 1　Introduction to Control Systems
1-1　引言
1–1　Introduction
1–2　控制系统实例
1–2　Examples of Control Systems
1–3　开环控制与闭环控制
1–3　Closed-Loop Control Versus Open-Loop Control
第二章　控制系统的数学模型
Chapter 2　Mathematical Modeling of Control Systems
2–1　概述
2–1　Introduction
2–2　机械系统的数学模型
2–2　Mathematical Modeling of Mechanical Systems
2–3　电气系统的数学模型
2–3　Mathematical Modeling of Electrical Systems
2–4　传递函数和脉冲响应函数
2–4　Transfer Function and Impulse-Response Function
2–5　其它建模方法
2–5　Additional techniques for modelling
2–6　用 MATLAB 进行系统数学模型之间的相互转换（**实验**）
2–6　Transformation of Mathematical Models with MATLAB（**Lab**）
第三章　控制系统的时域分析
Chapter 3　Time-domain Analysis of Control Systems
3–1　概述
3–1　Introduction
3–2　一阶系统
3–2　First-Order Systems
3–3　二阶系统
3–3　Second-Order Systems
3–4　高阶系统
3–4　Higher-Order Systems
3–5　劳斯稳定判据
3–5　Routh’s Stability Criterion
3–6　积分环节和微分环节对控制系统性能的影响
3–6　Effects of Integral and Derivative Control Actions on System Performance
3–7　单位反馈控制系统的稳态误差
3–7　Steady-State Errors in Unity-Feedback Control Systems
3–8　用 MATLAB 进行系统的瞬态响应和稳态误差分析（**实验**）

6–1 概述
6–1 Introduction
6–2 校正方法
6–2 Compensation Methods
6–3 PID 控制器的设计
6–3 Design of PID Controllers
6–4 PID 参数改变对控制系统的影响（实验）
6–4 Modifications of PID Control Schemes（Lab）

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

参考资料:
1. 《自动控制原理》,胡寿松主编,科学出版社.
2. 《自动控制原理》(上册),裴润,宋申民主编,哈尔滨工业大学出版社.
3. 《Modern Control Engineering》(5th Edition), Katsuhiko Ogata, Prentice Hall.
4. 《Control Systems Engineering》(7th Edition), Norman S. Nise, Wiley
5. 《控制系统计算机辅助设计-MATLAB 语言与应用》,薛定宇著,清华大学出版社.

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 Performance				
小测验 Quiz				
课程项目 Projects		15%		
平时作业 Assignments		15%		
期中考试 Mid-Term Test				
期末考试 Final Exam		60%		
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
