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**	ME307-16
4.	**课程学分 Credit Value**	2
5.	**课程类别 Course Type**	专业基础课 Major Foundational Courses
6.	**授课学期 Semester**	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	24	0	16	0	40

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

This course provides students a general background 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, its 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, as well as in the state space and how to take appropriate control actions to improve the system performance. The also address some advanced topics including controllability and observability of a control system, quadratic optimal control, as well as robust control.

16. 预达学习成果 Learning Outcomes

After completing this course, the students should learn the basic concepts and principles of control engineering, 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.)

Lectures

Eigenvalue Review	0.5
Laplace Transform Review	0.5
Defining A System Using Transfer Functions	0.5
Transfer Function for Physical System	0.5
Transfer Function and System Gain	0.5
Definitions for Transfer Functions	0.5
More Definitions for Transfer Functions	0.5
Linear Versus Nonlinear Systems	0.5
Linearization Basics	0.5
System Linearization	1
Multi-Variable Linearization	0.5
State-Space Model Basics	0.5
Circuit State-Space Modelling	0.5
State-Space Model to Transfer Function	0.5

State-Space Linearization	0.5
Poles and Zeros	0.5
Poles and Stability	0.5
More Poles and Stability	0.5
Imaginary Poles and Stability	0.5
State-Space Eigenvalues and Stability	0.5
Bounded-Input Bounded-Output (BIBO) Stability	0.5
System Time Response Terms	0.5
Second-Order System Time Response	0.5
Second Order System Damping & Natural Frequency	0.5
System Response with Zeros	0.5
Feedback Control Basics	0.5
Closed-Loop Transfer Function	0.5
Proportional Feedback Control	1
Integral and Derivative Control Introduction	0.5
Steady State Error (with Proportional Control)	0.5
More Steady State Error	0.5
PID Control	0.5
Steady State Error with the Final Value Theorem	0.5
More Closed-Loop Stability	0.5
Closed-Loop Transfer Function with a Sensor Transfer Function	0.5
Root Locus Setup	0.5
Root Locus Basics	0.5
Root Locus for Stability	0.5
Frequency Response	0.5
Bode Plot	0.5
Bode Plot Approximations	0.5
Bode Plot Stability	0.5
Stabilization with Bode Plots	0.5
Nyquist Criterion Introduction and Derivation	0.5
Contour Mapping	0.5
Nyquist Stability Criterion	0.5
laboratory sessions	
Eigenvalue with MATLAB	2
Transfer Function Analysis in MATLAB	2
Plotting in MATLAB	2
Feedback control in MATLAB	2
Feedback Control in MATLAB Simulink	2
Linearized Model of a Nonlinear System in MATLAB	3
Nonlinear System with a Linear Controller in MATLAB	3

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

Required: Control Systems Engineering 7th edition, by Norman S. Nise, Wiley

Suggested: Katsuhiko Ogada: Modern Control Engineering, 5th Edition, Pearson Prentice Hall

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		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