

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	信号与系统 Signals and Systems				
2.	授课院系 Originating Department	电子与电气工程系 Department of Electrical and Electronic Engineering				
3.	课程编号 Course Code	EE205				
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	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)	王锐 电子与电气工程系 副教授 (wang.r@sustc.edu.cn) Rui WANG (Associate Professor) Department of Electrical and Electronic Engineering 陈霏 电子与电气工程系 副教授 (fchen@sustc.edu.cn) Fei CHEN (Associate Professor) Department of Electrical and Electronic Engineering				
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	吴光 wug@sustc.edu.cn, 电子与电气工程系 Department of Electrical and Electronic Engineering				
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	无 NA
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	EE206 通信原理 Principles of Communication
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

<p>本课程涵盖信号与系统的基本知识，介绍以下 8 大方面的内容：</p> <ol style="list-style-type: none"> 1. 信号与系统的基本知识，包括单位冲击信号和单位阶跃信号，系统的特征 2. 线性时不变系统的特征和描述方法，包括单位冲击响应，卷积 3. 周期信号的傅里叶级数， 4. 连续时间信号的傅里叶变换 5. 离散时间信号的傅里叶变换 6. 采样和采样原理 7. 通信系统的调幅和调频的基本原理 8. 信号与系统相关的 Matlab 程序设计 <p>The subject covers the fundamentals of signals and systems. The main objective is to gain knowledge of eight main topics:</p> <ol style="list-style-type: none"> 1. The fundamental of signals and systems, unit impulse function and unit step function, and system characterization 2. The properties of linear time-invariant system, unit impulse response, and convolution 3. The process and properties of Fourier series representation of periodic signals 4. The process and properties of continuous-time Fourier transform 5. The process and properties of discrete-time Fourier transform 6. Sampling process and sampling theorem 7. Amplitude modulation and frequency modulation in communication systems 8. Usage of Matlab functionality for analyzing signals and systems
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16. 预达学习成果 Learning Outcomes

<p>通过这门课程的学习，学生能够：</p> <ol style="list-style-type: none"> 1. 掌握常用信号的定义，连续信号与离散信号的区别，信号的周期性和变换，以及系统的描述方法和特征，包括线性、时不变等 2. 了解线性时不变系统的特征，掌握单位冲击响应的概念，确定线性时不变系统的输出，卷积的定义和计算 3. 熟悉周期信号的傅里叶级数的定义和计算，掌握系统的特征函数和系统函数的含义，了解傅里叶级数的收敛条件和特征，离散信号傅里叶级数的特性，了解滤波的概念 4. 熟悉连续时间信号的傅里叶变换的定义、计算和特征，了解系统单位冲击响应和频率响应的关系，运用连续时间信号的傅里叶变换确定连续系统的输出，了解确定周期信号傅里叶变换的方法 5. 熟悉离散时间信号的傅里叶变换的定义、计算和特征，运用离散时间信号的傅里叶变换确定连续系统的输出 6. 掌握采样的过程和采样原理，熟悉信号重建的过程和系统实现，了解混叠的概念和特征，掌握设计数字系统处理连续信号的原理和技术，了解调整离散信号采样率的方法 7. 熟悉幅度调制/解调的原理和载波信号的影响，掌握幅度调整的同步和异步解调方法，了解频分复用技术，了解脉冲幅度调制 PAM 技术，及 PAM 信号传递过程中的相邻字符干扰的原理和解决方法，了解时分复用技术，了解频率调制

- 和相位调制技术的概念，和宽带/窄带调频方法的特征
8. 运用 MATLAB 软件工具对信号与系统进行分析，实现傅里叶级数和傅里叶分析，并运用滤波、调制等技术和方法进行系统设计的实验

After completing this course, the students will be able to

1. Understand the definitions of commonly-used signals, the difference between continuous-time signal and discrete-time signal, periodicity, signal transform, and know the descriptions and properties of systems
2. Understand the properties of linear time-invariant systems, the concept of unit impulse response, the methods to determine system output, and the definition and computation of convolution
3. Be familiar with the definition and computation of Fourier series representation of periodic signals. Understand the definition and meaning of eigen-function and system function, the convergence of Fourier series representation and its properties, the properties of Fourier series representation of discrete-time periodic signals, and the concept of filtering
4. Be familiar with the definition and computation of continuous-time Fourier transform, the relation between unit impulse response and frequency response, the methods to determine system output with continuous-time Fourier transform, and the approach to determine continuous-time Fourier transform of periodic signals
5. Be familiar with the definition and computation of discrete-time Fourier transform, and the methods to determine system output with discrete-time Fourier transform
6. Understand the sampling process and sampling theorem, the signal reconstruction from sampled signals, aliasing and its properties, the method to process continuous-time signal with a discrete-time system, and upsampling and downsampling
7. Know the principles of amplitude modulation, the effect of carrier signal, the synchronized and asynchronized demodulation methods, frequency-division multiplexing (FDM), pulse-amplitude modulation (PAM), inter-symbol interference (ISM) and its solutions, time-division multiplexing (TDM), frequency modulation and phase modulation, narrowband and wideband frequency modulation
8. Analyze signals and systems with Matlab functionality, implement Fourier series and Fourier transform, and utilize filtering and modulation methods to design signal processing experiments

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.)

理论课 Lecture

第 1 周: 信号与系统 I

Week 1: Signals and Systems I

第 2 周: 信号与系统 II

Week 2: Signals and Systems II

第 3 周: 线性时不变系统 I

Week 3: Linear Time-invariant Systems I

第 4 周: 线性时不变系统 II

Week 4: Linear Time-invariant Systems II

第 5 周: 周期信号的傅里叶级数 I

Week 5: Fourier Series Representation of Periodic Signals I

第 6 周: 周期信号的傅里叶级数 II

Week 6: Fourier Series Representation of Periodic Signals II

第 7 周: 连续时间信号的傅里叶变换 I

Week 7: Continuous-Time Fourier Transform I

第 8 周: 连续时间信号的傅里叶变换 II

Week 8: Continuous-Time Fourier Transform II

第 9 周: 离散时间信号的傅里叶变换 I

Week 9: Discrete-Time Fourier Transform I

第 10 周: 离散时间信号的傅里叶变换 II

Week 10: Discrete-Time Fourier Transform II

第 11 周: 采样 I

Week 11: Sampling I

第 12 周: 采样 II

Week 12: Sampling II

第 13 周: 通信系统 I

Week 13: Communication Systems I

第 14 周: 通信系统 II

Week 14: Communication Systems II

第 15 周: 信号与系统的时间和频率描述

Week 15: Time & Frequency Characterization of Signals and Systems

第 16 周: OFDM 系统介绍

Week 16: Introduction to OFDM System

实验课 Lab

第 1,2 周: Matlab 编程简介, 信号及系统

Weeks 1,2: Matlab Tutorial, Signals and Systems

第 3,4 周: 线性时不变系统

Weeks 3,4: Linear Time-Invariant Systems

第 5,6 周: 周期信号的傅里叶级数

Weeks 5,6: Fourier Series Representation of Periodic Signals

第 7,8 周: 连续时间的傅里叶变换

Weeks 7,8: Continuous-Time Fourier Transform

第 9,10,11,12 周: 信号与系统实验课学生项目 1

Weeks 9,10,11,12: Signal and Systems Student Project 1

第 13,14,15,16 周: 信号与系统实验课学生项目 2

Weeks 13,14,15,16: Signal and Systems Student Project 2

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

Oppenheim, Alan V., and A. S. Willsky. Signals and Systems. Prentice Hall, 1982. ISBN: 9780138097318.

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		30		
平时作业 Assignments		20		
期中考试 Mid-Term Test		25		
期末考试 Final Exam		25		
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)**

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20. 记分方式 **GRADING SYSTEM**

<input checked="" type="checkbox"/> A. 十三级等级制 Letter Grading <input type="checkbox"/> 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

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