

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	电路基础 Fundamentals of Electric Circuits				
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	EE104				
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	春季及秋季 Spring and 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)	张福才，副教授，电子与电气工程系 第二科研楼 305 室 zhangfc@sustc.edu.cn 叶涛，教授，电子与电气工程系 台州楼 207 室 yet@sustc.edu.cn				
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

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	MA101B 高等数学（上）A MA103A 线性代数 I-A 或 MA103B 线性代数 I-B MA101B Calculus I A MA103A Linear Algebra I A or MA103B Linear Algebra I B
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	本课程为通识通修课，也是微电子科学与工程、通信工程、光电信息科学与工程专业的先修课。主要后续课程包括模拟电子技术基础、数字电子技术基础、集成电路设计等。 This is an elective General Education course. It also serves as a prerequisite course for students who will major in Microelectronics Science and Engineering, Communication Engineering, and Optoelectronics Science and Engineering. The subsequent courses include "Fundamentals of analog electronics", "Fundamentals of digital electronics", and "Design of integrated circuits".
14. 其它要求修读本课程的学系 Cross-listing Dept.	无 None

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

<p>介绍电子电气电路的基本概念、基本定律、定理、分析方法,和电阻, 电容,电感,运算放大器, 独立电源和受控电源等基本电路元件的特性. 掌握直流电路, 交流一阶电路和二阶电路对正弦信号和一般信号的响应的分析方法, 以及电路的频率响应的概念. 熟悉交流电的功率计算方法、磁耦合电路的分析方法. 了解拉普拉斯变换及其在电路分析中的应用。</p> <p>To introduce the basic concepts, basic laws, theorems and analysis methods of electric circuits. To apply those theorems and laws for the analysis of DC circuits, first-order and second-order AC circuits, and magnetically coupled circuits. Familiar to concept and analysis method in frequency domain and Laplace transform and its application in circuit's analysis.</p> <ul style="list-style-type: none"> - Understand the basic concept, the fundamental laws and theorems, and the property of passive and active elements; - Be able to systematically obtain the equations that characterize the performance of an electric circuit as well as solving both single phase and three-phase circuits in sinusoidal steady state. - Acknowledge the principles of operation and the main features of electric machines and their applications. - Acquire skills in using electrical measuring devices.

16. 预达学习成果 Learning Outcomes

<p>通过本课程的学习，学生将系统地理解电路的概念和规律，并掌握直流、交流电路的分析方法。具体将掌握以下技能：</p> <ul style="list-style-type: none"> - 将数学、科学和工程知识应用于电路分析和设计的能力。 - 能够识别、制定和解决电路领域的工程问题。 - 在现实的约束条件下设计系统、组件或过程以满足所需需求的能力。 <p>After completing this course, students will comprehend the basic concepts and principles related to electric circuits, and also learn the methods of analysing both the DC and AC circuits. the students will be able to</p> <ul style="list-style-type: none"> - An ability to apply knowledge of mathematics, science, and engineering to the analysis and design of electric circuits - An ability to identify, formulate, and solve engineering problems in the area of circuits. - An ability to design a system, components or process to meet desired needs within realistic constraints

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.)**

1. 基本概念：介绍生活中常见的若干电路系统，介绍电荷、电压、电流、功率、能量等基本概念和电路元件；2学时；
 2. 基本定律：介绍欧姆定律、基尔霍夫电压和电流定律，推导串联电阻及其分压、并联电阻及其分流，介绍电阻网络的Y- Δ 变换；2学时；
 3. 电路分析方法：介绍节点分析法、网孔分析法，介绍含有电压源的节点分析法和含有电流源的网孔分析法；2学时；
 4. 电路定理：介绍线性电路性质、叠加定理、电源变换，介绍戴维南定理和诺顿定理，推导最大功率传输定理；2学时；
 5. 运算放大器：从实际运算放大器的简单介绍引入理想运算放大器模型，介绍反相放大器、同相放大器、加法放大器、差分放大器；2学时；
 6. 电容与电感以及一阶电路：介绍电容、电容的串联和并联、电感、电感的串联和并联；介绍无源RC电路、无源RL电路；介绍单位阶跃、单位冲激、斜坡等奇异函数，介绍RC电路和RL电路的阶跃响应，介绍一阶运算放大器电路；2学时；
 7. 二阶电路：电路响应的初值和终值计算，无源串联RLC电路及其阶跃响应，无源并联RLC电路及其阶跃响应，一般二阶电路，二阶运算放大器电路；2学时；
 8. 正弦交流电的基本概念：相位、幅值、频率、阻抗、移相器、AC电桥；2学时；
 9. 交流稳态分析：基尔霍夫定律，等效电路定律；2学时
 10. 交流功率分析：瞬时功率，平均功率，最大平均功率变换，有效值，视在功率，功率因数，2学时；
 11. 三相交流电：三相对称交流电压，对称电路的联接，对称电路联接方式间的等效变换，三相对称交流电路的功率计算；2学时；
 12. 磁场耦合电路：自感与互感，电路中能量存储，自耦变压器，三相变压器；3学时；
 13. 电路的频率响应：频率响应的基本概念，波特图，滤波器，有源滤波器；2学时；
 14. 电路的高级分析方法：拉普拉斯变换的定义及特性，拉普拉斯逆变换，拉普拉斯变换在电路分析中的应用；5学时；
1. Basic concepts: Introduce some common circuit systems in life, introduce basic concepts and circuit components such as charge, voltage, current, power, energy, etc. 2 hours;
 2. Basic laws: introducing Ohm's law, Kirchhoff's law of voltage and current, deducing series resistance and its voltage divider, parallel resistance and shunt, introducing Y-transformation of resistance network; 2 hours;
 3. Circuit analysis method: Introduce node analysis method and mesh analysis method, introduce node analysis method with voltage source and mesh analysis method with current source; 2 hours;
 4. Circuit Theorem: Introduce the properties of linear circuit, superposition theorem, power transformation, Thevenin theorem and Norton theorem, derive maximum power transmission theorem; 2 hours;
 5. Operational Amplifier: Introduce the ideal operational amplifier model from the simple introduction of the actual operational amplifier, introduce the reverse amplifier, in-phase amplifier, additive amplifier, differential amplifier; 2 hours;
 6. Capacitance and inductance as well as first-order circuit: introducing series and parallel connection of capacitance and capacitance, series and parallel connection of inductance and inductance, introducing passive RC circuit and passive RL circuit, introducing singular functions such as unit step, unit impulse and slope, introducing step response of RC circuit and RL circuit, introducing first-order operational amplifier circuit, 2 hours;
 7. Second-order circuit: initial and final value calculation of circuit response, passive series RLC circuit and its step response, passive parallel RLC circuit and its step response, general second-order circuit, second-order operational

- amplifier circuit; 2 hours;
8. Basic concepts of sinusoidal AC: phase, amplitude, frequency, impedance, phase shifter, AC bridge; 2 hours;
9. AC steady-state analysis: nodal law, mesh law, superposition law, power conversion, Thevenin-Norton equivalent circuit; 2 hours;
10. AC power analysis: instantaneous power, average power, maximum average power conversion, RMS, apparent power, power factor; 2 hours;
11. Three-phase AC: three-phase symmetrical AC voltage, symmetrical circuit connection, equivalent conversion between symmetrical circuit connection modes, power calculation of three-phase symmetrical AC circuit; 2 hours;
12. Magnetic field coupling circuit: self-inductance and mutual inductance, energy storage in the circuit, autotransformer, three-phase transformer; 3 hours;
13. Frequency Response of Circuit: Basic Concept of Frequency Response, Baud Diagram, Filter, Active Filter; 2 Hours;
14. Advanced circuit analysis methods: the definition and characteristics of Laplace transform, Laplace inverse transform, the application of Laplace transform in circuit analysis; 5 hours;

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

- Charles K. Alexander, Matthew N. O. Sadiku 著, 段哲民等译, 电路基础 (第 5 版), 机械工业出版社, 2014
- Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of electric circuits (Fifth Edition), 英文版 (第 5 版), 机械工业出版社, 2013
- James W. Nilsson, Susan A. Riedel 著, 周玉坤等译, 《电路》(第 9 版), 电子工业出版社, 2013
- 邱关源, 电路 (第 5 版), 高等教育出版社, 2006

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				
平时作业 Assignments		20		
期中考试 Mid-Term Test		40		
期末考试 Final Exam		40		
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

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