东北大学秦皇岛分校本科课程教学大纲

一、课程基本信息

<table>
<tr><td>开课单位</td><td colspan="3">计算机与通信工程学院</td><td>课程代码</td><td colspan="5">3100112012</td></tr>
<tr><td>中文名称</td><td colspan="8">电气电子工程导论</td></tr>
<tr><td>英文名称</td><td colspan="8">Introduction to Electrical and Electronic Engineering</td></tr>
<tr><td>总学时</td><td>44</td><td rowspan="2">理论学时</td><td rowspan="2">32</td><td rowspan="2">实验学时</td><td rowspan="2">12</td><td rowspan="2">上机学时</td><td rowspan="2">0</td><td rowspan="2">设计学时</td><td rowspan="2">0</td><td rowspan="2">课外学时</td><td rowspan="2">0</td></tr>
<tr><td>学　分</td><td>2.5</td></tr>
<tr><td>课程类型</td><td colspan="8">☐理论课程　☑理论（含实验）课程　☐实践类课程</td></tr>
<tr><td>课程类别</td><td colspan="8">☐通识类　☑学科基础类　☐专业方向类　☐实践类</td></tr>
<tr><td>适用专业</td><td colspan="8">通信工程</td></tr>
<tr><td>先修课程</td><td colspan="8">无</td></tr>
<tr><td>建议开课学期</td><td colspan="8">☑1-1 ☐1-2 ☐2-1 ☐2-2 ☐3-1 ☐3-2
☐4-1 ☐4-2 ☐5-1 ☐5-2 ☐*（代表每学期都开设）</td></tr>
<tr><td>考核方式</td><td colspan="3">☑考试 ☐考查</td><td>成绩分制</td><td colspan="4">☑百分制 ☐五级制 ☐二级制</td></tr>
<tr><td>使用教材</td><td colspan="8">1、 ALLAN R. HAMBLEY. Electrical Engineering Principles and Applications, Seventh Edition, Publishing House of Electronics Industry, 2018</td></tr>
<tr><td>参考书及教学资源</td><td colspan="8">1、 Allan R. Hambley, 电工学原理与应用（第五版）（中文版）, 电子工业出版社, 2012.
2、 邱关源. 电路（第五版）, 高等教育出版社, 2006.</td></tr>
<tr><td>其他说明</td><td colspan="8">无</td></tr>
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二、课程简介

中文描述

本课程是一门面向通信工程专业本科生的学科基础类课程，是本专业后续课程的基石。本课程所覆盖的核心知识领域包括电路基本概念、电阻电路分析、动态电路分析、正弦稳态电路分析，提供了系统的分析电路的基本方法和技术。课程致力于培养学生对于电子电路理论的理解，以及将理论知识应用于解决实际问题的能力。

通过本课程的学习，学生将能够建立起基础的理论知识框架，这对于他们未来在学术上进一步深入研究或在职业生涯中从事与电子通信相关的工作至关重要。在实践操作方面，学生将学会如何进行电路的抽象建模，以及如何对电路进行分析，这将大大增强他们在实际工作中分析和解决复杂电路问题的能力。同时，课程还旨在培养学生的创新意识和实践能力，鼓励他们勇于探索、勤于实践，以实现电路及其模型的调整、优化和创新设计。

本课程还注重培养学生的家国情怀和四个自信。通过学习电路知识，学生不仅能够获得实用的技能，还能够在学习过程中增强对中国特色社会主义文化自信及工匠精神的认同，树立起正确的世界观、人生观和价值观，从而更好地服务于国家的发展和人民的福祉。

English Description

This course is a fundamental subject course for undergraduate students majoring in communication engineering and serves as the cornerstone for subsequent courses. The core knowledge mainly include basic concepts of circuits, analysis of resistive circuits, dynamic circuit analysis, and sinusoidal steady-state circuit analysis, providing systematic methods and techniques for analyzing circuits. The course is dedicated to cultivating students' understanding of electronic circuit theory and the ability to apply theoretical knowledge to solve some practical problems.

Through the study of this course, students will be able to establish a framework of basic theoretical knowledge, which is crucial for their further academic research or careers in electronic communication-related fields. In terms of practical operations, students will learn how to abstractly model circuits and how to analyze them, which will greatly enhance their ability to analyze and solve some circuit problems in actual work. Additionally, the course aims to cultivate students' sense of innovation and practical ability, encouraging them to explore and practice diligently to achieve the adjustment, optimization, and innovative design of circuits and their models.

This course also emphasizes the cultivation of students' national sentiment and the "Four Confidences" (confidence in the path, theory, system, and culture of socialism with Chinese characteristics). By learning circuit knowledge, students not only acquire practical skills but also enhance their identification with the cultural confidence and craftsmanship spirit of socialism with Chinese characteristics during the learning process. This helps them establish a correct world outlook, outlook on life, and values, thereby better serving the country's development and the well-being of the people.

三、课程目标

1、知识目标：

1-1：理解电路的基本概念和基本元件，包括电压、电流、电阻、电容、电感等，以及它们在电路中的作用；

1-2：掌握电阻电路的分析；

1-3：掌握直流动态电路的分析；

1-4：掌握正弦稳态电路的分析；

1-5：掌握理想变压器、二极管和整流器的基本原理；

1-6：掌握传递函数和滤波器的基础知识。

2、能力目标：

2-1：具备初步的电子线路分析能力、设计能力；

2-2：提高分析电路和操作实验的能力，初步奠定综合设计的基础；

2-3：培养初步的工程思维和创新能力。

3、德育/素养目标：

3-1：培养学生严谨的科学态度，追求真理，勇于探索未知，培养学生用科学的方法分析问题和解决问题；

3-2：培养良好的团队协作意识和能力、较强的表达能力和人际交往能力；

3-3：具有良好的跨文化、跨领域沟通能力，能够在本专业相关领域进行有效的技术沟通和交流；

3-4：培养学生的国家意识和社会责任感。

表 1 课程目标与毕业要求的对应关系

毕业要求	指标点	课程目标	关联 (H/M/L)
1. **工程知识**：能够将数学、自然科学、工程基础和专业知识用于解决复杂工程问题。	指标点 1-2：掌握通信原理、信号与信息处理、电子电路技术等专业知识，具备通信系统功能模块设计开发能力和通信与信息系统设计开发与维护能力。	1-1、1-2、1-3、1-4、1-5、1-6、2-1、2-2、2-3、3-1、3-2、3-3	H
4. **研究**：能够基于科学原理并采用科学方法对复杂工程问题进行研究，包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。	指标点 4-1：能够基于科学原理并采用科学方法，在本专业相关理论指导下对复杂工程问题设计实验进行研究。	1-1、1-2、1-3、1-4、2-1、2-2、2-3、3-1、3-2	M

四、主要教学内容

（一）理论教学

第 1 章：Introduction（支撑教学目标 1-1、2-1、2-2、3-1、3-2、3-3、3-4）

【1】知识点：

(1) Circuit elements: resistance elements, voltage sources and current .

(2) Kirchhoff's law.

【2】学习目标：

理解：Real circuit and circuit model, Power conservation.

掌握：The reference direction of current and voltage, the characteristics of the elements and the relationship between voltage and current, Kirchhoff's law.

【3】重点内容：

(1) The reference direction of voltage and current.

(2) Calculation of power.

(3) Kirchhoff's law.

【4】难点内容：

(1) Calculation of power.

(2) The programming style and documentation.

(3) Application of Kirchhoff's law.

【5】思政案例：

Using the issues of chips, the development of China's electricity, and Ultra High Voltage technology to enhance students' sense of crisis, the spirit of self-reliance and independence, as well as national pride and patriotic sentiment, explain that science and technology is the primary productive force.

第 2 章：Resistive Circuits（支撑教学目标 1-2、2-1、2-2、2-3、3-1、3-2、3-3）

【1】知识点：

(1) Equivalent transformation of circuits, resistors in series/parallel .

(2) The equivalent circuit of the resistance Y connection and Δ connection.

(3) Voltage source and current source in series/parallel, two models of actual source supply and their equivalent transformation.

(4) Node-voltage analysis.

(5) Mesh-current analysis.

(6) Superposition principle and substitution principle.

(7) Thevenin theorem and Norton theorem.

(8) Maximum power transfer for DC circuits.

【2】学习目标：

理解：Resistors in series/parallel; Understanding the concepts of mesh currents and nodal voltages;.

掌握：Two models of actual source supply and their equivalent circuits; Node-voltage analysis; Mesh-current analysis; Superposition principle and substitution principle; Thevenin theorem and Norton theorem; Maximum power transfer for DC circuits.

【3】重点内容：

(1) the models of actual source supply and their equivalent circuits.

(2) Calculation of power.

(3) Both all basic circuit theories.

【4】难点内容：

(1) The equivalent circuit of the resistance of Y type connection and Δ type connection; Calculation of input resistance of a port circuit.

(2) Node-voltage analysis; Mesh-current analysis.

(3) Applying all basic circuit theories to analyze the circuit.

【5】思政案例：

Through study, one can understand that different circuits have different analysis methods, and the same problem can also be solved in different ways, which implies that in different situations in life, there are also different approaches. When encountering problems, there are always more methods than

problems.

第 3 章：Inductance and Capacitance（支撑教学目标 1-3、2-1、2-2、2-3、3-1、3-2、3-3）

【1】知识点：

(1) Capacitors and inductors.

(2) Capacitors in series/parallel.

(3) Inductors in series/parallel.

【2】学习目标：

理解： The concepts and meanings of zero-input response, zero-state response, and complete response.

掌握： The VCR of capacitors and inductors; The establishment method of dynamic circuit equations; Transients in first order RC circuits.

【3】重点内容：

(1) The Voltage-Current Relationship (VCR) of a inductor element.

(2) The Voltage-Current Relationship (VCR) of a capacitor element.

(3) Capacitors in series/parallel.

(4) Inductors in series/parallel.

【4】难点内容：

(1) VCR of a inductor element.

(2) VCR of a Capcitor element.

第 4 章：Transients（支撑教学目标 1-3、2-1、2-2、2-3、3-1、3-2、3-3）

【1】知识点：

(1) First-Order RC Circuits.

(2) Zero state response.

(3) Zero input response.

(4) Full response.

【2】学习目标：

理解： The concepts and meanings of zero-input response, zero-state response, and complete response.

掌握：The establishment method of dynamic circuit equations; Transients in first order RC circuits.

【3】重点内容：

Time-domain analysis for first-order circuits..

【4】难点内容：

Understanding and application of first order circuits.

【5】思政案例：

Using the combination of dynamic components and resistors to test bullet speed illustrates that even with simple knowledge, one can design solutions that meet engineering requirements. This cultivates students' ability to analyze and solve problems using scientific methods and increases their interest in learning.

第 5 章：Steady-State Sinusoidal Analysis（支撑教学目标 1-4、2-1、2-2、2-3、3-1、3-2、3-3）

【1】知识点：

(1) Complex, phasor and the phasor form of the circuit law.

(2) Impedance and admittance.

(3) Steady-state AC node-voltage and mesh-current analysis.

(4) Equivalent circuits and maximum average power transfer for AC sources and complex load

impedances.

【2】学习目标：

理解： The relationship between sinusoidal quantities and phasors; the significance of phasor method in analyzing sinusoidal steady-state circuits.

掌握：the phasor form of the circuit law; mpedance and admittance; Analyze the circuit with phasor method; maximum average power transfer for AC sources and complex load impedances.

【3】重点内容：

Analysis of sinusoidal circuit with phasors method.

【4】难点内容：

(1) Sinusoidal steady state circuit analysis with phasors and complex impedance and its power.

(2) maximum average power transfer for AC sources and complex load impedances.

【5】思政案例：

Viewing AC and DC with the dialectical relationship between universality and particularity, guiding students to see the essence through phenomena.

第 6 章：Ideal transformers, Diodes and Rectifier circuits（支撑教学目标 1-4、2-1、3-1、3-3）

【1】知识点：

(1) Magnetic induction and ideal transformers.

(2) Diodes.

(3) Rectifier circuits.

【2】学习目标：

理解：Basic Principles of Ideal Transformers, Diodes, and Rectifier Circuits.

掌握：The volt-ampere relation of coupled inductance, including the analysis of coupled inductance circuits; Principle of transformer; The power of a coupled inductor.

【3】重点内容：

(1) Mutual inductance.

(2) Principle of transformer.

【4】难点内容：

The power of a coupled inductor.

第 7 章：Transfer functions and filters（支撑教学目标 1-1、2-1、2-2、3-1、3-2、3-3、3-4）

【1】知识点：

(1) Transfer functions.

(2) First-order RC lowpass filters.

(3) Bode plots.

(4) First-order RC high-pass filter.

【2】学习目标：

理解：The purpose and significance of Bode plots.

掌握：Transfer functions; First-order RC low-pass filters; First-order RC high-pass filters.

【3】重点内容：

Transfer functions.

【4】难点内容：

Bode plots.

（二）实验教学

This course aims to enable students to acquire basic theories, knowledge, and skills in analog

electronic technology, and systematically master the working principles and analysis methods of some commonly used electronic devices and basic electronic circuits. Through experiments, cultivate comprehensive design ability, data retrieval ability, instrument practical ability, fault detection ability, and practical development ability. To enable students to master the usage of commonly used electronic instruments and the testing methods of common electronic circuits, cultivate their ability to analyze and solve problems, and lay a foundation for the subsequent study of related courses. The project names and class hour allocation related information for experimental teaching are shown in Table 2.

表 2　实验教学信息表

序号	实验项目名称	实验学时	每组人数	实验类型	实验性质
1	Experimental Verification of Kirchhoff's Law	2	1	Verification	Required
2	Study and Equivalent Transformation of External Characteristics of Voltage Source and Current Source	2	1	Design	Required
3	Experiments on Superposition and Homogeneity of Linear Circuits	2	1	Design	Required
4	Experimental of Thevenin’s Theorem and Norton Theorem	2	1	Design	Required
5	First-order RC Circuit Response Test	2	1	Design	Required
6	Sinusoidal Steady State AC Circuit Simulation Experiment	2	1	Design	Required

实验项目一：Experimental Verification of Kirchhoff's Law（支撑教学目标 1-1、2-1、2-2、3-1、3-2）

【1】实验内容：

Draw circuit diagrams using Multisim simulation software; Setting of current and voltage reference direction; Voltage and current measurement methods; Verify Kirchhoff's law.

【2】实验目的：

Understand the reference direction of voltage and current, master the measurement method of voltage and current, and verify Kirchhoff's law.

【3】教学要求：

Verify the correctness of Kirchhoff's law and deepen the understanding of Kirchhoff's law; Correctly understand the relationship between the actual direction of voltage and current and the reference direction.

【4】实验方式：Simulation

【5】实验场地与设备：Comprehensive building 1108, MULTISIM simulation software.

【6】思政案例：

By applying Kirchhoff's law to real-life situations, students can learn that things in life are just like laws, and without rules, they cannot form a circle. They should always abide by corresponding laws and regulations and follow a series of rules.

实验项目二：Study and Equivalent Transformation of External Characteristics of Voltage Source and Current Source（支撑教学目标 1-2、2-1、2-2、2-3、3-1、3-2）

【1】实验内容：

Draw circuit diagrams using Multisim simulation software; Measure the external characteristics of voltage and current sources; Test the conditions for equivalent transformation between voltage source and current source.

【2】实验目的：

Master the test method of the external characteristics of the power supply, verify the equivalent conversion conditions of the voltage source and the current source

【3】教学要求：

Familiar with the usage of Multisim software; Understand the external characteristics of ideal current sources and ideal voltage sources; Verify the conditions for equivalent conversion between voltage source and current source.

【4】实验方式：Simulation.

【5】实验场地与设备：Comprehensive building 1108, MULTISIM simulation software.

【6】思政案例：

The indomitable discovery of Ohm's Law by Ohm cultivates the essence of students' fearlessness of difficulties; Potential calculation introduces the ups and downs of life.

实验项目三：Experiments on superposition and homogeneity of linear circuits（支撑教学目标 1-2、2-1、2-2、2-3、3-1、3-2）

【1】实验内容：

Draw circuit diagrams using Multisim simulation software; Test the superposition theorem; Study the applicability of the superposition theorem.

【2】实验目的：

Familiar with the usage of Multisim software; Understand the superposition and homogeneity of linear circuits.

【3】教学要求：

Verify the correctness of the superposition principle of linear circuits, deepen the understanding and comprehension of the superposition and homogeneity of linear circuits.

【4】实验方式：Simulation.

【5】实验场地与设备：Comprehensive building 1108, MULTISIM simulation software.

【6】思政案例：

Emphasizing the indispensable role of each independent source in the circuit, similar to the individual contributions of team members in completing tasks together. Guide students to recognize the importance of teamwork and cultivate their awareness of taking responsibility within the team.

实验项目四：Experimental of Thevenin’s theorem and Norton theorem（支撑教学目标 1-2、2-1、2-2、2-3、3-1、3-2）

【1】实验内容：

Learn how to use Multisim simulation software; Master the measurement method of equivalent

circuit parameters for active two terminal networks.

【2】实验目的：

Learn to use integrated operational amplifiers to construct RC bridge oscillation circuits; Learn the testing method for frequency selection characteristics of RC series parallel networks; Learn how to use Multisim virtual oscilloscope to measure oscillation frequency.

【3】教学要求：

Master the composition and oscillation conditions of RC sine wave oscillator; Learn to measure and debug oscillators.

【4】实验方式：Simulation.

【5】实验场地与设备：Comprehensive building 1108, MULTISIM simulation software.

【6】思政案例：

In experimental teaching, some students have difficulties in the circuit design part and have negative learning emotions. By sharing successful design ideas, they emphasize the "craftsman spirit" and "scientific spirit", and promote the "research spirit" of not fearing difficulties.

实验项目五：First-order RC circuit response test（支撑教学目标 1-3、2-1、2-2、2-3、3-1、3-2）

【1】实验内容：

Draw circuit diagrams using Multisim simulation software; Transient response simulation of first-order RC circuit; Transient response simulation of first-order RC circuit under square wave excitation.

【2】实验目的：

Familiar with zero state response, zero input response, and full response of first-order RC circuits; Study the basic laws and characteristics of the response of first-order circuits under step excitation and square wave excitation; Master the basic concepts of integral circuits and differential circuits; Learn to calculate the time constant τ of an RC circuit from the response curve.

【3】教学要求：

Master the testing methods for zero state response, zero input response, and full response of first-order RC circuits.

【4】实验方式：Simulation.

【5】实验场地与设备：Comprehensive building 1108, MULTISIM simulation software.

【6】思政案例：

In experimental teaching, students are encouraged to explore different circuit configurations or component parameters to observe different response characteristics. This exploration process can stimulate students' innovative spirit and thirst for knowledge.

实验项目六：Sinusoidal Steady State AC Circuit Simulation Experiment（支撑教学目标 1-4、2-1、2-2、2-3、3-1、3-2）

【1】实验内容：

Draw circuit diagrams using Multisim simulation software; Simulation of phasor forms for KCL, KVL, and VCR; Experimental simulation of fluorescent lamp circuit.

【2】实验目的：

Learn and master the basic principles and analysis methods of sine steady-state AC circuits; Verify

Kirchhoff's voltage and current laws in phasor form; Research methods to improve power factor; Use Multisim software for circuit design and simulation to deepen understanding of circuit theory knowledge.

【3】教学要求：

Master the basic principles and analysis methods of sine steady-state AC circuits, and learn to verify Kirchhoff's voltage and current laws in phasor form.

【4】实验方式：Simulation.

【5】实验场地与设备：Comprehensive building 1108, MULTISIM simulation software.

【6】思政案例：

Through simulation experiments of sine steady-state AC circuits, students can learn and apply scientific methods, including setting experimental parameters, collecting and analyzing data, etc. This helps cultivate students' exploratory spirit and scientific analysis ability.

五、教学安排与学时分配

This course aims to delve into the fundamental concepts, theories, principles, and practical operations of circuits through a combination of theoretical teaching and experimental teaching. In theoretical teaching, the course starts with the basic structure of circuits, progressively unfolding and elaborating on circuit analysis methods, characteristics of electrical components, solution of circuit equations, and circuit design methods. In experimental teaching, the course makes full use of offline laboratory classes and online teaching resources to carry out circuit experiment operations and analysis, enabling students to deepen their understanding of circuit theory through practice and enhance their experimental skills and innovative spirit. Through a variety of teaching methods and in-depth content, this course aims to cultivate students’ national sentiment and the concept of a strong nation, guiding them to establish a correct outlook on life, the world, and values based on a solid foundation of circuit knowledge.

表 3 学时分配表

讲课内容		学时				
		讲课	实验	上机	设计	课外
第 1 章	Introduction	4	2	0	0	0
第 2 章	Resistive Circuits	6	6	0	0	0
第 3 章	Inductance and Capacitance	2	0	0	0	0
第 4 章	Transients	4	2	0	0	0
第 5 章	Steady-State Sinusoidal Analysis	8	2	0	0	0
第 6 章	Ideal transformers, Diodes and Rectifier circuits	4	0	0	0	0
第 7 章	Transfer functions and filters	4	0	0	0	0
小计		32	12	0	0	0
总计	44					

六、教学方法

1、Teach the basic principles, integrate theory with practice, emphasize the application and design principles of circuit components, and cultivate students’ innovative capabilities

2、Combine knowledge teaching with moral education, using a teaching method that integrates multimedia courseware, online teaching, and traditional teaching, bringing vitality to the classroom. Integrate with new teaching channels.

3、.Combine theoretical teaching with discussion forms, motivate students’ enthusiasm for learning, cultivate their self-learning ability, teamwork ability, and the ability to solve practical problems.

七、成绩评定

1、This course is assessed based on the concept of full-process monitoring. The course assessment consists of four parts: regular class performance, laboratory work, mid-term exam, and final exam. The specific requirements and grading methods are as follows:

(1) Regular class performance accounts for 10%, mainly including classroom interaction, homework, online material study, and other comprehensive evaluations;

(2) Laboratory work accounts for 20%, mainly involving laboratory operations and the writing of laboratory reports;

(3) Mid-term exam scores account for 30%, based on test paper scores (closed-book examination);

(4) Final exam scores account for 30%, based on test paper scores (closed-book examination).

2、Students who miss more than one-third of the required experiments, homework, or who are absent for more than one-third of the scheduled class hours, or who fail the laboratory assessment, will be disqualified from the course assessment.

八、评价及持续改进

1、Teaching Syllabus

Assessment Cycle: 4 years.

Revision Cycle: 4 years.

Improvement Measures: The course leader organizes all teachers of the course team to discuss and propose improvement suggestions, which are then reviewed by the director of the teaching and research office and approved by the dean of teaching.

2、Academic Performance

Assessment Assessment Cycle: 1 academic year.

Evaluation Basis: Comprehensive analysis of students’ final grades.

Improvement Measures: Based on the distribution of students’ final grades, corresponding content adjustments and optimizations are made, and teaching methods are improved.

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