【Electrical and Electronic Technology】

1. Basic information

Course number：【2080414】

Credits：【4 credits】

Object oriented ：【Mechanical Engineering、Automobile Service Engineering、Aviation Maintenance Management】

Course Nature：【Obligatory Course】

Department：College of Electrical and Mechanical engineering

Main Teaching References:

【Alexander, C. and Sadiku, M. (2004) *Fundamentals of Electric Circuits*. Fourth Edition, *McGraw-Hill.*】

【Sedra, A. and Smith, K. (2014) *Microelectronic Circuits*. Seventh Edition, *Oxford University Press.* 】

【"Floyd, T. L. (2014) Digital Fundamentals. Eleventh Edition, Pearson".】

【Agarwal, A. and Lang, J. (2005) *Foundations of Analog and Digital Electronic Circuits*. First Edition, *Morgan Kaufmann.* 】

Other References that students can use:

【Electrical Engineering Principles and Apllications, edited by Allan R.Hambley, Publishing House of Electronics Industry, October 2012 Fifth Edition】

Supplementary teaching materials：

【Electronics in Electrical Engineering,edited by Ye Tingxiu, Higher education press, July 2014 Fourth Edition】

【Electrical Engineering Edited by Qin Zenghuang, higher Education Press December 2003 6th edition】

【Electronics in Electrical Engineering, edited by Lv Houyu, Chongqing University Press July 2001】

Course website：

Prerequisite courses： 【Advanced Mathematics, College Physics】

2. Course Description

This course is an important technical basic course for undergraduate non-electric classes such as machinery, thermal energy, electromechanical, vehicle and other majors in higher industrial schools.

It is an introductory technical basic course in electrical and electronic technology, which is a comprehensive system of analog electronic technology, digital electronic technology, Circuit Analysis Foundation and Electrical Foundation, and is a highly practical course. Its mission is to enable students to acquire basic theories, basic knowledge and basic skills in

electrical and electronic technology through the study of this course, to develop students ' ability to analyze and solve problems, to master basic circuit analysis methods, to familiarize themselves with the basic working principles of analog electronic technology and digital electronic technology, This course provides a good basis for further study of some areas of electrical and electronic technology and the professional application of electrical and electronic technology.

3. Course Selection Advice

This course is suitable for undergraduate students majoring in mechanical engineering, Automobile Service Engineering as well as in Aviation Maintenance Management. Students are required to have basic knowledge and skills in higher mathematics and college physics, to master the analysis and calculation methods of AC/DC. Students should understand simple Analysis and design method of combinatorial logic circuit; Ability to analyze simple sequential logical circuit.

4. Course Contents

Modules	Contents	Competency Requirements	Teaching Emphases
1.Basic theorem and basic analysis method of circuit.	1. Know the circuit model and physical quantity. **(L1)** 2.Mastery of Ohm's law; Kirchhoff law; Equivalent transformation method of voltage source and current source. **(L2)** 3. Know the concept of branch, node, loop. **(L1)** 4. Understand the meaning of active two-port network, passive two-port network, Thevenin's theorem and the method of circuit equivalent transformation. **(L2)** 5. Master the method of circuit analysis and calculation of branch current method, node voltage method, superposition principle and Thevenin's theorem. **(L3)**	1. Be able to use the basic theorem to carry on the simple DC circuit analysis and the calculation. 2. Be able to communicate with students based on simple circuits.	1. Understanding and application of Kirchhoff's law 2. Application selection and application range of several different circuit analysis methods. 3. Mastery of teaching skills

2. AC Circuit Analysis and transient process of the circuit	1. Understand the three elements of sinusoidal quantity and the concept of AC circuit power. **(L1)** 2. Understand the concept of circuit transient process, the physical meaning of circuit time constant, dynamic circuit equation and initial conditions. **(L1)** 3. Understand the commutation laws, transient process, differential circuit and integral circuit of RC and RL circuits. **(L2)** 4. Master the three-element method of first-order circuit transient analysis to solve the transient voltage and current. **(L3)**	1. Able to use the basic knowledge of AC circuit for simple AC serial and parallel circuit calculation. 2. Analyse the transient response of RC Circuit to a square wave	1. basic concepts of sinusoidal alternating current. 2. Transition process of RC circuit.
3. The Ideal Operational Amplifier	1. The basic operation of op-amps. **(L2)** 2. Analysis of ideal op-amp circuits. **(L3)** 3. Op-amp applications. **(L3)**	1. Understand the basic concept of operational amplifiers, voltage transmission characteristics and main parameters. 2. Master the basic analysis methods of ideal operational amplifiers. 3. Understand the concept of feedback and understand the influence of feedback type and negative feedback on the performance of the amplifier. 4. Be able to carry out proportional operation, addition and subtraction operation	1. Addition and subtraction operations. 2. concept of feedback and the influence of negative feedback on the performance of the amplifier
4. The integrated gate circuit and combinational logic circuit	1.Common logic gate circuits; **(L2)** 2. TTL gate circuit; **(L2)** 3. Basic algorithm of logic algebra; **(L3)** 4. Analysis and design of combinatorial logic circuits; **(L4)** 5. Integrated binary encoder and binary decoder **(L5)**	1. Able to identify different gate circuit symbols; 2. Able to use TTL gate circuit gate circuit; 3. Able to simplify logical functions. 4. Able to carry out the analysis and design of combinatorial logic circuit; 5. Ability to encode and decode using encoders and decoders.	1. Analysis and design of combinatorial logic circuits 2. Binary encoder and Binary decoder

5、The name and basic requirements of the course experiment

index	Experimental Name	Main content	hours	Type	Remark
1	Verification of Thevenin's theorem	1. Learn the use of electrical instrumentation and measurement of voltage, current and resistance methods; 2. Validate the Thevenin's theoremis verified by measuring the open circuit voltage and the equivalent internal resistance to find the branch current.	4	verification	
2	The response of RC circuit to rectangular pulse	1. Learn to use signal generators and oscilloscopes; 2. Observe the output waveform of differential and integral circuits 3. Adjust the time constant of RC circuit by changing the capacitance 4. Study the response of different time constants of RC circuit to rectangular pulse.	4	verification	
3	The applications of Integrated operational Amplifier	1. Measure and carry out proportional operation, addition and subtraction operation are carried out by using the characteristics of integrated operation in linear zone 3. Understand the principle of signal amplification and the cause of Comparation of the voltage signal by using the characteristics of the integrated operation in the nonlinear zone	4	verification	
4	Logic function test of gate circuit	1. Further familiar with the function and measurement method of the logic gate circuit; 2. Learn how to connect and debug logical combinatorial circuits.	4	verification	

6. Assessment system and Evaluation method

Assessment system （1+X）	Assessment Item	Percentage (%)
1	Final Exam	40
X1	Experimental operation and report	20
X2	Homework and in-class questions	20
X3	middle term exams.	20

7. Teaching schedule

Calendar week	Lecture #	Teaching content	Teaching methods
1	1	**Introduction to DC-Circuits:** • International System of Units (SI); • Basic Physical Quantities of Circuits; • Calculation of voltage, current, power and energy.	Lecture/Tutorial Problems
	2	**DC-Circuit Laws:** • Ohm's Law; • Active and Passive Networks (Series, Parallel, Y & Delta).	Lecture/Tutorial Problems
	3	**DC-Circuit Laws continued:** • Source Transformation; • Voltage & Current Division; • Kirchhoff's Laws.	Lecture/Tutorial Problems
2	4	**Methods of DC-Circuit Analysis:** • Mesh Analysis.	Lecture/Tutorial Problems
	5	**Methods of DC-Circuit Analysis:** • Nodal Analysis.	Lecture/Tutorial Problems
	6	**DC-Circuit Theories:** • Superposition Principle.	Lecture/Tutorial Problems
3	7	**DC-Circuit Theories Continued:** • Thevenin's Theorem; • Maximum Power Transfer.	Lecture/Tutorial Problems
	8	**Capacitors and Inductors:** • Capacitors and Inductors;	Lecture/Tutorial Problems

	9	**First-Order Circuits:** • Source Free RC Circuits; • Step Response RC Circuit.	Lecture/Tutorial Problems
4	10	**Revision and Tutorial Exercises on DC-Circuits Analysis**	Tutorial Problems
	11		
	12		
5	13	**Mid-term Exam**	Examination
	14	**Midterm Solution and Discussion**	Exam Discussion
	15	**Analysis of AC-Circuits:** • Sinusoids; • Transient Response in RC Circuit.	Lecture
6	16	**The ideal Op-Amp:** • Analysis of Op-Amp Circuits; • Op-Amp Configurations; • Op-Amp Applications.	Lecture
	17	**Digital Logic Design:** • Introduction to Digital Logic.	Lecture/Tutorial Problems
	18	**Digital Logic Design Continued:** • Boolean Logic; • Decimal and Binary Number.	Lecture/Tutorial Problems
7	19	**Digital Logic Design Continued:** • Combinational Logic Circuits.	Lecture/Tutorial Problems
	20	**Introduction to DC and AC Signal Measurements**	Lecture/Simulation
	21	**Revision and Tutorial Exercises**	Tutorial Problems
8	22		
	23		
	24	**Final Exam**	Examination

Author：Ahmad Taha Approved: